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THE CADMIUM CELL.

The advantages of the cadmium cell as a primary standard of electromotive force are now well recognized. Its temperature coefficient is small, compared with the Clark cell, and the electromotive force is near unity in value. Until recently we had every reason to believe that its permanence was at least equal to that of the Clark cell, and it was no more difficult to set up. It was with these ideas in mind that the substitution of the cadmium cell has been urged to replace the Clark cell, which has heretofore been the recognized standard; in fact, this substitution has been recommended by a number of scientific bodies, and at the recent meeting of the British Association for the Advancement of Science a report was made by the committee on practical standards of electrical measurement in which the change is recommended.

Unfortunately, as we have already noted, more recent work with the cadmium cell has thrown some doubt upon its permanence, and it is a coincidence that at the same time that the report of the British Association's meeting comes to hand an article appears in the *Physical Review* for August, contributed by Professor George A. Hulett, on this subject. Professor Hulett's work with the Clark cell is well known, and he here gives some of his most recent results. They bear out the opinion expressed somewhat earlier in the year—that is to say, that, as at present constructed, the cadmium cell can hardly supplant the Clark cell as a primary standard of electromotive force. Until the cause of the trouble has been located or avoided, it would seem well not to make any change in our standard. This criticism should be applied to the cadmium cell merely as it is now constructed. The inference is not that the cadmium cell will not eventually supplant the Clark cell; in fact, we have good reason to hope that the change may be made with confidence before long. It will be remembered that just such difficulties were encountered in bringing the Clark cell up to its present highly developed condition. But until there is no question as to the reliability of the cadmium cell there should be no change made in our standard.

COAL VALUES.

That method of producing coal in which the price paid depends upon the amount of useful combustible is coming into use, though slowly. It is a rather remarkable fact that though a few power companies adopted this method about ten years ago, but little or no thought was given to the matter by the managers of the greater number of power stations. No expense whose object was to increase the efficiency of the boiler house or to decrease the cost of generating steam was grudged, but few went back of this, and all accepted whatever coal was sent

to them, for which they paid the stipulated price. That this was poor policy is now generally believed, and coal is purchased now, by many important stations, at least, according to the amount of combustible in it. A reduction in price is made for the amount of ash and for the amount of moisture which must be evaporated, and which thus causes a loss of heat.

The question has been raised, whether the ash acts merely as a diluent or whether it is not detrimental in other ways. Moreover, it seems likely that the size of the coal will have some effect upon the performance of the furnace, either as respects its efficiency or the rate at which fuel may be burned. An exceedingly interesting and valuable paper dealing with these problems was read at the recent meeting of the Western Society of Engineers by Mr. W. L. Abbott. Mr. Abbott has conducted a long series of experiments, made to determine the effect upon furnace efficiency and performance, of the size of the coal, of the thickness of the fire, and of the amount of ash. His paper appears on another page of this issue, and it should be read by all who have to do with steam generation. Although the ground has not yet been fully and satisfactorily covered, the results already obtained are significant and important. As regards the effect of ash, it was found that besides acting as a diluent of the combustible, ash is detrimental in other ways. If a coal contain a high percentage of ash it then not only has a correspondingly less amount of combustible, but such coal can not be burned as effectively in the furnace. There is less combustible on the grate for a given thickness of fire, and to burn it completely requires an excessive amount of air. Thus the efficiency of the furnace is lowered, since the temperature is lowered; and, what is equally important, in most cases, the capacity of the boiler is reduced—that is to say, less steam can be produced. The penalty for ash should therefore not be simply proportional to the amount of ash, but should involve some power of this factor. For instance, it was found by Mr. Abbott that the efficiency of his furnace, and therefore the capacity of his boilers, was reduced to zero when about forty per cent of ash was present in the coal. Therefore, coal containing sixty per cent of combustible has no value as a fuel under the conditions of the test.

Next in importance to the amount of ash is probably the size of the fuel. This seems to have an irregular action—that is to say, taking the coal that is passed by screens of different sizes, it was found that the efficiency first increases with the size of the screen, then decreases and then again increases. The best results are obtained when the coal is fairly uniform in size. These results show that, given two coals, each having the same percentage of ash and of moisture, that which runs most uniform in size should be given the higher value, and in the purchase of coal this factor should be given some weight. To determine the way in which the penalty should be brought in, a large number of experiments were conducted and from them a table constructed which assigns values to the coals, according to the size of the screen through which they have passed. Probably, dealers in coal will object to such discrimination, holding that the value of a coal depends upon the amount of combustible it contains; but from the central station's point of view the availability of the heat generated is as important as its amount, and therefore that coal which may be burned most efficiently or which will produce the greatest amount of steam in a given boiler is the most valuable.

Another feature studied by Mr. Abbott, and mentioned above, was the effect of the thickness of the fire. This, of course, has nothing to do with the price to be paid for the coal, but for each kind of coal there is, undoubtedly, a particular thickness which gives the best results. An interesting fact shown by the experiments was that the efficiency of the furnace is practically independent of the thickness of the fire; but a thick fire, due to the deficiency of air, gives incomplete combustion and therefore produces smoke. The thin fire may be smokeless. Although the efficiency of the furnace is unaffected, the capacity of the boiler is. It was found that with small-sized fuels the greatest amount of steam was secured when a large amount of smoke was produced. We have heard so much of late regarding the inefficiency of smoky furnaces, but the results just mentioned seem to indicate that a large amount of smoke does not mean necessarily that the furnace is being badly managed. It may mean simply that it is doing a large amount of work, and it is an important advantage to the central station if two boilers may be made to do the work of three. It does not follow from these results that the furnace in question might not be improved and the same amount of steam generated without the smoke by introducing certain improvements in it. But the fact that a smoky chimney does not prove that the furnace is being managed badly is a point well worth bearing in mind. We hope that the experiments will be carried further, for the work has not yet been completed, and any light thrown upon problems of burning and of purchasing fuel is most acceptable.

THE MAGNETIC INDICATOR FOR HARDENING STEEL.

Unusual applications of peculiar electric or magnetic phenomena are always interesting, but particularly so when the phenomena in question have not been made use of. A case of this kind is that described by Mr. William Taylor before the British Association at its recent meeting at York, England. After having contended some time with the difficulties of getting the proper temperature for hardening tool steel, Mr. Taylor tried a thermo-junction pyrometer, thinking that in this way he would get accurate temperature indications and thus be able to control his furnace. Unfortunately, the pyrometer was not satisfactory, for while it gave accurate temperature indications, it did not show when the critical temperature of the sample being tested was reached, and it thus became necessary to obtain a cooling curve for each lot of steel.

It occurred to Mr. Taylor that, since the critical temperature for tempering is also a critical temperature magnetically, he might avail himself of the magnetic change in order to guide his tempering work. His attempts to do this were most successful. The method by which he experimentally demonstrated that the idea could be utilized in practice consisted in arranging a

circuit containing two coils and a telephone receiver. Through a third coil, placed between these two coils, was sent an alternating current, and the positions of the coils were adjusted until no sound was heard in the receiver. Then, interposing between either of the outer coils and the central one a piece of iron or steel, a sound was immediately heard in the receiver; but when the sample of metal was heated to its critical point it lost its magnetic properties and the sound ceased. It was then quenched. Using this test, he found that there was no difficulty whatever in tempering his tools, and that, in consequence of it, warping and changes of size were avoided. It was found that if the sample was allowed to cool below the critical points, so that sound was again heard in the telephone, the tempering was imperfect. As the apparatus described is hardly suitable for factory work, a modified instrument was made. This consisted of a permanent horseshoe magnet having extended soft-iron poles. One of these poles was arranged so as to rock back under normal conditions. By placing the sample of steel to be tempered at the tips of the two soft-iron poles, both were held down by magnetic attraction; but when the sample was heated until it lost its magnetic properties the rocking pole was at once released, and, flying back, gave the signal for quenching. This device was found to be of great practical service in making the work of miscellaneous hardening safe and certain in its results. By means of it tempering is carried out at temperatures less than that used by a skilled workman, and in this way overheating, resulting in brittleness, cracking and warping, is avoided.

This is a very ingenious use of a peculiar property of iron, and, so far as can be recalled, it is the only one making use of it. Many years ago an endeavor was made to utilize this property for generating electric currents, but it was unsuccessful, the efficiency being too low and the output of the apparatus comparatively small.

HIGH-SPEED AND FLYING CONNECTIONS.

Among the advantages which may be secured by means of electric traction, should the necessity arise, will be higher speeds and the safeguards which must go with them. An interesting suggestion in this direction was made in a recent discussion of the advantages of electric traction by Mr. C. F. Jenkin before the British Association. Mr. Jenkin believes that if high speed be introduced every station on the road will demand express service, and he suggests that the difficulty of giving it might be overcome by introducing what he calls slip cars—that is to say, each train has attached to it a number of cars which may be detached as it proceeds at full speed. Passengers for a certain station or group of stations will be gathered together in the last car, and as this approaches their destinations the car will be separated from the train and follow it under its own power. To give a corresponding service in the opposite sense it would be necessary for the cars to start from the stations as the train approaches and to attach themselves to it while running at full speed. The plan seems rather visionary at present, though some such method of operation may become necessary.

AN ANTICIPATION FOR THE TELEPHONE.

The extension of the telephone system has been so rapid as to make its use general in the smaller towns and villages and even in sparsely settled country districts, and now the natural anticipations are toward its universal use. Arguments as to its utility are trite, the demand exists, and the limitation is that of cost.

It is puerile to demand that the price of telephone service must be reduced merely because it brings a profit, which is true likewise of the price for anything else which is bought; and yet the whole of the technical and administrative skill of the telephone companies are concentrating their abilities upon the reduction of costs, and bestow the benefits of such reductions upon their patrons. Step by step the rates are being lowered, and what is of vastly more importance the service is being segregated into different classes suited to the needs of various patrons and the prices made in accordance with the measure of the service which is sold.

The expense of the rural telephone service is already reduced to a minimum under existing conditions, and yet the line and pole expense increase with longer distances into sparsely settled districts, and the growing price of poles, with every prospect of an increased price of copper, will add to the cost of all such lines in the future.

How is the skilled inventor to meet this problem? Selective ringing instruments are in abundance, and those types which are successfully operative under conditions of practical usage are of value in affording improvements to the service, although such devices would deprive the other nineteen inquisitives on a rural line of the opportunities to reenforce their knowledge of their neighbor's affairs by their wonted custom of removing the telephone and listening in whenever the bell rings.

This is not the solution of the problem, as selective ringing would add to the cost as well as improve the character of the service.

The line of improvement must be in adding to the traffic capacity of telephone lines. This has been done in the telegraph, and the telephone has improved in the same direction by the phantom circuit by which two metallic circuits may be made to serve as three circuits, and another instance is that which permits the simultaneous use of telegraph and telephone service over the same line. And in somewhat more than an experimental manner telephones have been used upon lines which simultaneously carry electric lighting or power currents.

Will some one amplify this usefulness of a single telephone circuit by extending its functions to simultaneous transmissions of speech, and make the invention practical by allowing such transmissions to divide to other circuits at the switchboard, and thence each on its own course as may be needed?

The difficult portion of this problem, like that of the present use of the telephone and the operation of the electric railway car, is that it must be capable of use without skill by the patron at the telephone.

The power of doubling the service over a telephone would be of great value, and who can deny that it is not within reason to expect that this may not be done with the telephone as it has been done in greater measure with the telegraph?

FUEL, WATER AND GAS ANALYSIS FOR STEAM USERS.[1]

BY JOHN B. C. KERSHAW.

I—NATURAL AND ARTIFICIAL FUELS: THEIR ORIGIN, COMPOSITION AND METHODS OF SAMPLING.—*Concluded.*

Semi-Anthracite or Steam Coal—Fuels which when heated yield from ten to twenty per cent of volatile matter, are known as semi-anthracite or steam coals. They are very largely used for steam-raising purposes in the Royal navy and by factories located in cities where smoke prosecutions are frequent. Approximate analysis of typical semi-anthracites are given below:

No.	Ash.	Volatile Matter.	Coke.	Calculated Calorific Value in Centigrade Units.
	Per Cent.	Per Cent.	Per Cent.	
1....	14.95	10.00	90.00	7,405
2....	15.25	11.80	88.20	7,398
3....	10.00	12.50	87.50	7,855
4....	10.75	13.60	86.40	7,783
5....	8.85	15.50	84.50	7,950

Fuels of this type can be burned without smoke production in most types of boiler furnaces, and they do not require large combustion chambers or very skilled management in order to obtain perfect combustion. As shown by the approximate analyses, the greater portion of the fuel remains as an incandescent mass of coke after the preliminary heating upon the firebars of the furnace, and radiation transfers the heat from this mass of glowing fuel to the water in the boiler.

Anthracite—Anthracite is the nearest approach to coke in chemical constitution which is found naturally, but it differs from coke in its physical properties, being very dense and of shining appearance. Anthracite gives off only from three to ten per cent of volatile matter when heated, and consists chiefly of fixed carbon, with little oxygen or hydrogen.

The following is an approximate analysis of a typical South Wales anthracite fuel:

sh.	Volatile Matter.	Coke.	Calorific Value.
Per Cent.	Per Cent.	Per Cent.	
1.70	3.64	96.36	8,305

Anthracites are difficult to ignite, owing to their density and low percentage of volatile matter; but under proper conditions this type of fuel can be burned completely and yields a very intense but localized heat. Anthracite is chiefly used in metallurgical operations, and is not employed to any great extent for steam-raising purposes; but when so employed no combustion chamber is required, and the boiler surface may be placed close to the mass of burning fuel.

Petroleum and Its By-Products—Although liquid fuels have little application in the United Kingdom, owing to the limited supply available for industrial purposes, in Russia and the United States they are largely used for heating and steam-raising purposes. Crude petroleum contains a large number of liquid hydro-carbons of the general formula $C_n H_{2n+2}$, and it is the crude oil or the residues obtained in refining it that is used for steam-raising purposes. In Russia, especially, the residue from the first distillation of the crude oil, called "astatki," is utilized also most entirely in this way.

The following tests[1] show the difference in composition and heating value of the Russian and American oils.

	Per Cent Carbon.	Per Cent Hydrogen.	Per Cent Oxygen.	Calorific Value.
Russian crude light..	86.3	13.60	0.10	22,628
" " heavy.	86.5	12.3	1.1	19,440
" astatki.....	87.1	11.7	1.2	19,260
Pennsylvania crude..	84.9	13.7	1.4	19,224
West Virginia crude..	86.6	12.9	0.5	21,240

When burnt in suitable furnaces with proper provision for the supply of the oil in the form of a spray, petroleum is superior to ordinary coal as a fuel, and has thirty-three per cent higher evaporative value than anthracite. Actual tests have given an evaporation of 20.8 pounds of water per pound of petroleum. Liquid fuel is easily transported and stored; yields no ashes on combustion, and were the supply of crude oil sufficient there is little doubt that it would be very largely used for steam-raising purposes in this and other countries. Under present conditions, however, the price of petroleum is too high to enable it to compete with coal as a fuel.

ARTIFICIAL FUELS.

Gas-Coke and Coke-Oven Coke—These two forms of fuel are obtained by submitting bituminous fuels to dry distillation—that is, by heating in closed retorts or ovens in the absence of air. The moisture and volatile constituents of the coal are driven off, and only the carbon, ash and impurities remain—as a solid residue in the retorts or ovens. Gas-coke is the residue obtained in the manufacture of coal-gas, and here the quality of coke is of secondary importance to that of the gas. The coke produced from coke ovens, on the other hand, is the chief product of the coking process, being designed for use in the iron smelting industry, and in many cases the gases from coke ovens are allowed to escape into the atmosphere.

The use of coke for steam-raising purposes is very limited, since its price is comparatively high; but it is sometimes purchased and mixed with bituminous fuel, to lessen the trouble from smoke in very heavily worked boiler plants. Coke can be burned completely without any combustion chamber.

The following is an approximate analysis of a typical coke:

Ash.	Volatile Matter.	Coke.	Calorific Value.
Per Cent.	Per Cent.	Per Cent.	
18.85	1.90	98.10	6,972

Owing to the loss of the volatile constituents of the fuel, the percentage of ash in coke is always higher than that of the original fuel.

Coke contains, as a rule, from 2.0 per cent up to 6.0 per cent of moisture, owing to its absorbent properties and to the fact that on drawing from the retorts or ovens it is often quenched with water.

Coke contains also a large portion of the sulphur impurity of the original fuel, and it is not, therefore, a very suitable fuel for use in towns or cities for the reasons already given under Bituminous Fuel.

Peat-Coke—This artificial fuel is obtained by the dry distillation of peat in retorts of special design, after a large portion of the original water contents of the peat have been removed by mechanical methods. The following is an analysis of a peat-coke prepared by an electrical method:

	Per Cent.	
Moisture	17.50	
Ash	18.00	on the dried sample.
Volatile matter.....	57.60	
Coke	42.40	
Fixed carbon.....	24.40	

This test must not be taken as representative of peat-coke generally, however, as it is possible by scientific methods to obtain a much lower percentage of moisture, and of volatile matter in the finished product. The ash test in this case has also been increased by the unwise addition of chemicals to promote electrical conductivity.

A sample of peat-coke from Argyleshire contained only 6.50 per cent moisture and 2.70 ash; while Norwegian peat-coke contains 4.82 per cent moisture and 3.0 per cent ash.

Although peat-coke has not so far been manufactured upon a large scale, it is now being produced at several small works in Norway, Canada, Ireland, Germany and other peat-producing countries. When the coal fields of Europe and America are exhausted, peat-coke is likely to play an

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[1] "The Calorific Power of Fuels," H. Poole.

important rôle—in the maintenance of the world's industries. Owing to its percentage of volatile matter and freedom from sulphur—peat-coke is a far more perfect fuel for household and industrial use than ordinary coal.

Briquette Fuels—Briquette fuels are made chiefly from semi-anthracite and anthracite coal by mixing the dust and fine coal obtained in the course of mining and screening with tar or other binding materials and by moulding the mixture into bricks in specially designed presses. The resulting briquettes burn slowly with evolution of little smoke, and find a large use in Germany and other European countries for domestic purposes. The following shows the composition of such a briquette fuel made from German peat:

	Per Cent.	
Moisture	10.78	
Ash	7.35	on dry sample.
Coke	36.50	
Volatile matter.....	63.50	
Fixed carbon.....	29.15	

As the cost of briquette fuel delivered in manufacturing districts is higher than that of coal, it is little used for industrial and steam-raising purposes.

Gaseous Fuel—There are many engineers who believe that the power and heat required by our industries in the future will be obtained from gaseous fuel. Some of the advantages of this form of fuel have already been mentioned. Others are that with slight modifications in the gas-producing apparatus the gas obtained can be used either for heating or for power purposes. Large gas engines driven by producer-gas (obtained from ordinary bituminous slack costing only 6*s*. per ton d/d) have now been running satisfactorily for some years in Germany, in America and in the United Kingdom; and as one horse-power can be obtained from one pound of coal by this method, the advantage over the present methods of power generation are undoubted. Even with the existing power plants—consisting of steam boilers and reciprocating or turbine engines—there is much to be said for heating by gas, and in many works the installation of a large gas-producer plant would lead to fuel economy, and incidentally also solve the smoke problem.

Producer-gas varies in composition with the type of producer used, the method of working and with the composition of the fuel consumed. When steam is used in the working of producers, a mixture of ordinary producer-gas and water-gas is obtained. Carbon monoxide and hydrogen are the essential heating constituents of producer-gas and upon the percentage of these constituents present in the gas its thermal value depends.

The earlier forms of gas-producers could only be worked satisfactorily with semi-anthracite and anthracite fuel. Modern producers and methods of working permit the cheapest forms of bituminous slack to be employed with satisfactory results. The ammonia recovered in the form of sulphate as a by-product is also of considerable value. The following is the composition of gas from a typical Mond gas plant, using cheap fuel:

		No. 1. Per Cent.	No. 2. Per Cent.
CO_2	(Carbon dioxide).....	16.3	16.0
CO	(Carbon monoxide)....	10.2	11.0
CH_4	(Methane).....	2.5	2.0
H	(Hydrogen).....	26.4	29.0
N	(Nitrogen).....	44.6	42.0
		100.0	100.0

No. 2 gas has a heating value of 140 British thermal units per cubic feet, and contains eighty-four per cent of the thermal value of the original fuel. In the writer's opinion the transition from steam engines to gas engines for power generation will be marked by an intermediate stage in which gaseous fuel will be employed for steam-raising purposes.

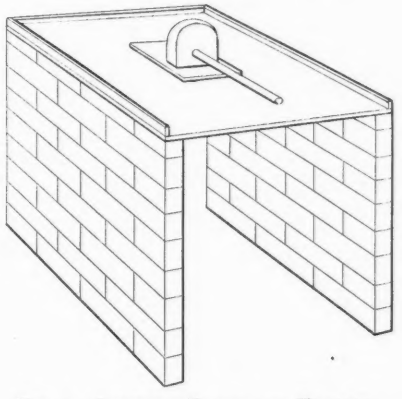


FIG. 1.—SAMPLING PLATE AND HAMMER.

Sampling Fuels—The sampling of fuel has not in the past received from engineers the attention it requires. It is perfectly useless having elaborate chemical and calorific tests made of fuel, if the sample be a non-representative one. In the majority of instances, in which engineers have submitted fuel samples to the writer for analysis or report, they have evidently given little thought or attention to the problem of sampling the fuel. The sampling operation is in fact one demanding as much care and attention as the later chemical examinations; and the idea, that a few pounds of coal selected haphazard from any part of a wagon-load or heap of fuel, can form a representative sample is utterly absurd.

The sampling of slack and small fuel is simpler than the sampling of mixed large and small coal, but in each case a truly representative sample of coal can only be obtained by strict adherence to the rules for sampling given below. The sampling of liquid fuels is simplest of all, since here the contents of a barrel or tank can be well mixed by blowing air through or, in the case of tar, by using a plunger for a few minutes before taking the sample. The only difficulty then is the selection of the number of barrels from which to take samples, and the usual proportion in sampling work is every third or fifth—excepting when the total number is small—when every barrel may be sampled with little extra expenditure of time.

The sampling of peat and briquette fuels is best carried out by taking borings out of a large number of selected blocks, and reducing these to powder by rubbing between serrated iron plates. A proper sampling-plate and suitable hammer (Fig. 1) are required for the preparation of fuel samples when this work is often carried out, and in large works where fuel sampling is a regular portion of the scientific management of the plant a small mortar mill or large crushing and grinding mill is essential for the speedy performance of the work.

The ordinary type of coffee mill is useful for crushing samples of fuel in the final stage of their preparation for laboratory examination.

RULES FOR SAMPLING FUEL.

As each barrow-load of fresh portion of fuel is taken from the pile or store heap a count is kept of the number used, and the whole contents of each tenth or twentieth barrow or portion are placed on one side, in a cool place, under cover. Care must be taken that the barrow or portion selected for the sample does not contain an unfair proportion of lumps or smalls.

At the end of the day, or period for which the sampling is to be carried on, the heap of fuel obtained for sampling purposes, as described above, is transferred to a sampling-plate, and the larger lumps are all crushed down to walnut size. Should no sampling-plate be available, four of the iron plates used for covering manholes and boiler flues may be utilized to obtain a hard clean surface on the floor of the boiler house, and the crushing down of the sample may be carried out on these plates with any heavy and flat lump of iron at hand. The heap of fuel, after this first crushing, is thoroughly mixed by turning over and over with a spade. The heap is then flattened

down, two lines are made across it at right angles with the edge of the spade, and two of the four opposite sections are selected to form the reduced sample. The lumps in this are again crushed, the sample is again mixed, and the quartering operation repeated until about eight or ten pounds of fuel only remain, with no lumps that will not pass through a quarter-inch sieve. Two one-pound tins, with ordinary or patent lids, are filled from this remaining heap of fuel, after thoroughly mixing the same with the hands or with a small shovel. One of these tins is to be sent per parcels post to the fuel expert for analysis; the other is to be kept for reference in case of dispute.

(To be continued.)

BOOK REVIEWS.

"The American Steel Worker." Second edition. E. R. Markham. New York. The Derry-Collard Company. Cloth. 366 pages. 5¾ by 8 inches. 163 illustrations. Supplied by the ELECTRICAL REVIEW at $2.50.

The experience of twenty-five years' working with steel and in the selection, annealing, hardening and tempering of various kinds and grades is brought together in book form for the benefit of those who have to do with such operations. The work is eminently practical, as it not only states clearly the end sought, but gives detailed instructions in each case for obtaining it. There is an excellent index to the book.

"Designs for Small Dynamos and Motors." Cecil P. Poole. New York. McGraw Publishing Company. Cloth. 186 pages. 6½ by 9½ inches. Illustrated. Supplied by the ELECTRICAL REVIEW at $2.

This book has been compiled by bringing together twenty-two designs of small dynamos and motors which originally appeared in the *American Electrician.* The designs have been prepared with a view to obtaining a machine as simple as possible and one easily constructed by means of the facilities ordinarily obtainable by amateurs. The machines considered vary from motors rated at one-sixth to three horse-power, to a 400-ampere electroplating dynamo, a four-kilowatt combined alternating and direct-current generator, and a single-phase rectifier.

"A Graphical Treatment of the Induction Motor." Alexander Heyland. New York. McGraw Publishing Company. Cloth. 48 pages. 5¾ by 8¼ inches. Illustrated. Supplied by the ELECTRICAL REVIEW at $1.

This well-known and widely discussed graphical treatment of the induction motor, which is really a special application of the general transformer diagram, was published first in 1894. It is based on two simple and quickly performed experiments. The value of such methods, both to the student and to the constructing engineer, is well known. In this volume the translators have put in convenient form the original discussion of the method by Heyland. Heretofore imperfect treatments of the subject only have been available in text books, and those who wished to go into the subject further have been forced to follow it up through the various technical periodicals. The present translation will therefore be very acceptable to all who are not at home in the language of the original.

"Handbook of Mathematics." J. Claudel. New York. McGraw Publishing Company. Cloth. 708 pages. 6½ by 9½ inches. Illustrated. Supplied by the ELECTRICAL REVIEW at $3.50.

This is a translation of the seventh edition of Claudel's handbook of mathematics. It is intended for engineers as well as for engineering students—in fact, it would seem to be more suitable for the latter class of users, for it covers practically the entire field of mathematics involved in ordinary engineering computations, and the engineering student usually has covered a considerable part of this ground before he takes up the special branches employed in his profession. For engineers, however, it gives in convenient and easily referred to shape the essential parts of the various branches of mathematics, including arithmetic, algebra, geometry, trigonometry, analytical geometry and calculus. In these branches it gives not only the fundamental principles, but those abbreviated processes which are such time-savers. The value of the book is considerably added to by the numerous examples presented, although these are of a rather general character. For the engineer who is occasionally forced to brush up his mathematics this book will be very acceptable.

"Stray Currents from Electric Railways." Dr. Carl Michalke. Translated and edited by Otis Allen Kenyon. New York. McGraw Publishing Company. Cloth. 90 pages. 6 by 8¼ inches. Illustrated. Supplied by the ELECTRICAL REVIEW at $1.50.

In this book are brought together the results of many careful investigations made in Europe to determine the actual conditions existing regarding stray currents from electric railways. The author has made a painstaking study of the reports, and gives his conclusions here. He does not, however, offer any general method of preventing electrolytic troubles, since there are too many factors depending upon local conditions which enter into the problem. His deductions are not at all startling, and, in fact, are in good agreement with the opinions held by the best-informed engineers. It is, of course, impossible to prevent leakage of current from the rails when they are employed as the return circuit. It is also impossible to prevent entirely current from entering underground piping systems when they are not perfectly insulated from the ground. It is possible, however, when bad conditions exist, to find means of alleviating them considerably. At the ninety German cities where investigations were made there were only two or three cases where there had been any serious trouble from leakage currents.

"Illustrated Technical Dictionary in Six Languages." Vol. i. Compiled by K. Deinhardt and A. Schlomann. New York. McGraw Publishing Company. Cloth. 404 pages. 4½ by 7½ inches. Supplied by the ELECTRICAL REVIEW at $2.

A novel plan has been adopted in this dictionary. Instead of employing the ordinary alphabetical arrangement, certain words are grouped together, each group dealing with some particular division of engineering. This particular volume is a dictionary of the elements of machinery and the tools most frequently employed in metal and woodworking. It is in six languages—English, German, French, Russian, Italian and Spanish—and all six terms are given together, accompanied, where possible, by a drawing illustrative of the apparatus referred to. With such an arrangement it is impossible at once to find the word sought, so that an auxiliary section becomes necessary in which all the words are arranged alphabetically. To use this dictionary it is necessary, therefore, first to look in the index for the word sought, and then to turn to the page and section there indicated in order to find it and its foreign equivalents. While there may be occasions in which the grouping together of words in this way is advantageous, it would seem that the double work required in order to find the meaning of the word sought would more than offset the compactness aimed at. When using a dictionary one always wishes to do so with the least amount of trouble and distraction, and the double search required would seem to be a decided disadvantage. Moreover, the necessity of adding to the dictionary proper an index containing all of the words in the dictionary prevents the full realization of a compact book which is sought by the peculiar plan adopted. An engineer does not usually carry his technical dictionary with him, as he may his handbook. It is usually employed as an instrument to facilitate his work at the office, and for this purpose one enabling him to turn at once to the word sought is by far the best.

SOME CHARACTERISTICS OF COAL AS AFFECTING PERFORMANCE WITH STEAM BOILERS.[1]

BY W. L. ABBOTT.

The capacity and efficiency obtained with a steam boiler is the result of many influences more or less variable in character, and for the purpose of studying some of these influences certain experiments were conducted in which coal screenings were used, the results of which are presented in this paper.

The apparatus employed in the researches to be considered consisted of two Babcock & Wilcox boilers, one being fourteen tubes high and eighteen wide, of approximately 5,000 square feet of heating surface, fitted with a chain-grate stoker seventy-five square feet in area, which discharged the gases of the fire from under an ignition arch five feet long, immediately among the tubes of the boiler; this boiler was also fitted with a Babcock & Wilcox superheater having an approximate area of 1,000 square feet. The other apparatus employed in one of the series of tests differed only in sizes; its boiler was twelve tubes high and sixteen wide, contained 4,000 square feet of heating surface, provided with a superheater and served with a chain-grate stoker sixty-six square feet in area.

The experiments were for the purpose of studying the following features and their influence with the particular apparatus used, and are presented in the following order:

Effect on capacity and efficiency due to coal of different sizes.

Influence of ash in coal on capacity and efficiency.

Effect of variation in size of coal screenings.

Results of different thicknesses of fire.

The experiments illustrated by the diagram (Fig. 1) consisted in the use of coal separated into various sizes by means of screens having the following square openings: 0.25, 0.50, 0.75, 1.0 and 1.25 inches. The coal was all from one lot, so that the different portions resulting from the screening process where necessarily the "same kind of coal," except that some portions were uniformly larger and others smaller, and that the smallest, on account of its size, was higher in ash. As shown by the curves of efficiency and capacity in the diagram, five tests were made, each with a different size of coal. In all other respects, however, everything was equal; thus influencing conditions, except that due to size of coal, were constant. In this way relative values for the feature studied were obtained as shown by the diagram.

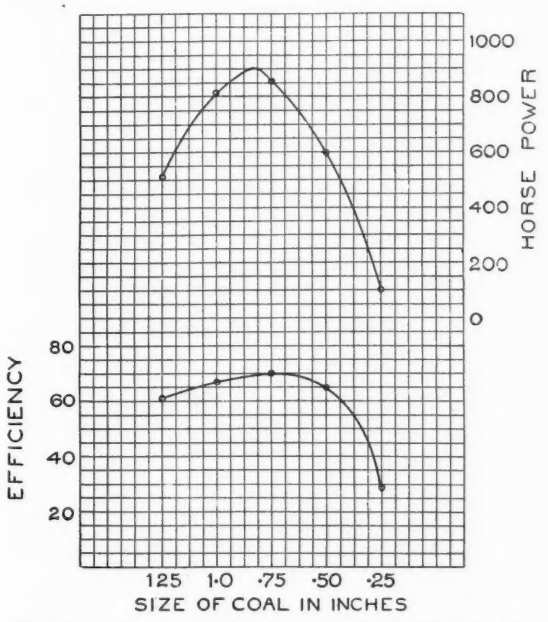


FIG. 1.—EFFECT ON CAPACITY AND EFFICIENCY DUE TO COAL OF DIFFERENT SIZES.

It is well in this connection to give the percentage of ash in the dry coal of the various sizes.

	Square Screens. Through.	Over.	Ash in Dry Coal.
Size of coal in inches..	1.25	1.00	13.7
" " " " " ..	1.00	0.75	14.0
" " " " " ..	0.75	0.50	15.6
" " " " " ..	0.50	0.25	20.8
" " " " " ..	0.25	0.00	30.8

The high per cent in the smallest size is not due to ash in the coal itself, but to the fact that all of the fine-sized foreign matter separated from larger coal, or which comes from roof or floor of the mine, naturally finds its way into this smaller coal.

INFLUENCE OF ASH IN COAL ON CAPACITY AND EFFICIENCY.

This diagram (Fig. 2) gives results of eighteen tests made to determine the effect of varying quantities of ash associated with coal. One result of its presence is to reduce the heating power, owing to displacement of combustible matter. Therefore, in this connection, ash may be considered as a dilutant, and if this was the only result of its presence, it would have no effect on heat efficiency secured through a boiler. A proportionately less amount of water would be evaporated by a pound of such mixture of ash and coal, of course, but efficiency would not be affected. If, however, ash acts in some other way as well, such as an obstruction to the combustion process, the effect of its presence is doubly harmful.

To ensure that the result would not be affected by any influence other than that of the ash, special coal was used which came from the No. 7 seam, north of Marion, in Williamson county, Ill. It was prepared in a Stewart washer and is known to the trade as No. 4 washed coal, a size made by passing over a screen having one-quarter-inch round openings, and through one having similar one-half-inch openings. Its composition is represented by the following:

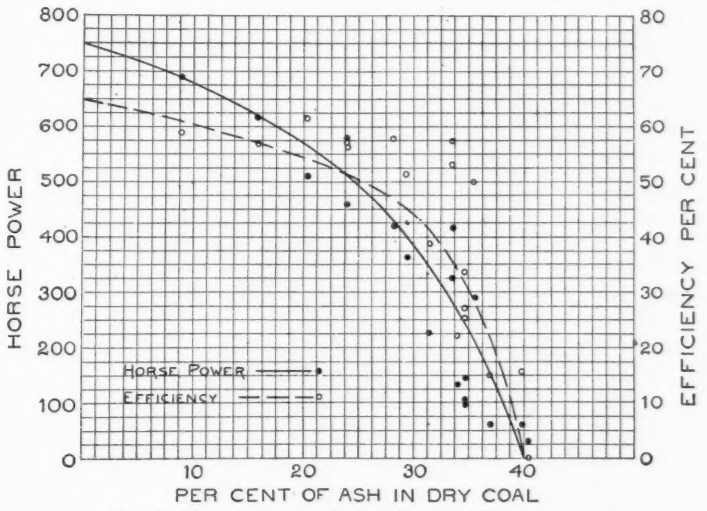


FIG. 2.—INFLUENCE OF ASH IN COAL ON CAPACITY AND EFFICIENCY.

Moist coal:	
Moisture	7.48
Ash	8.23
British thermal units	12,191
Dry coal:	
Ash	8.90
British thermal units	13,176
Pure coal:	
British thermal units	14,463

The test indicated by the two points showing highest efficiency and capacity

[1] Paper read before the Western Society of Engineers September 5.

was made with coal just as it arrived, or in other words, was of the composition shown by the analysis. Beginning with the test of the second day a quantity of refuse from the stoker ash pits was added to the coal to be used. This refuse was first weighed and the large pieces broken up, after which it was thoroughly mixed with the coal in the required proportion and increasing amounts were added in each test which followed. This fuel composition was, of course, weighed as used and a sample of it selected for analysis in the regular manner.

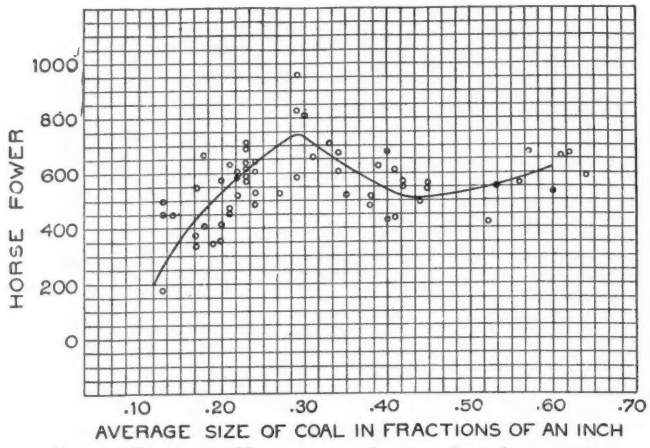


FIG. 3.—EFFECT OF VARIATION IN SIZE OF COAL SCREENINGS.

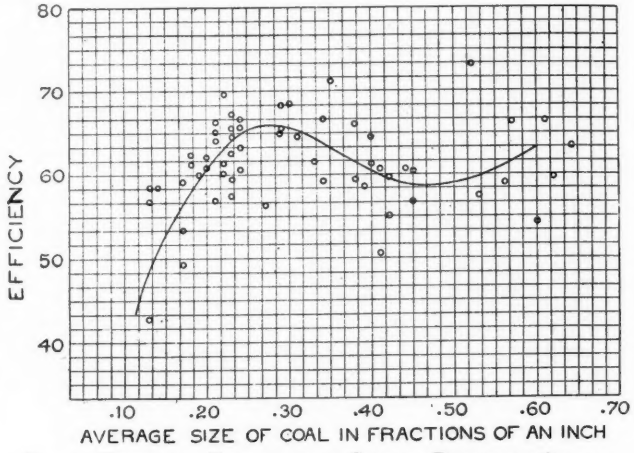


FIG. 4.—EFFECT ON EFFICIENCY OF COAL OF DIFFERENT SIZES.

It appears from the diagram that useful effect from the fuel drops to zero with forty per cent of ash, notwithstanding the fact that the other sixty per cent of the composition was pure coal. The fact should be emphasized, that although over half of the composition fed to the fire was fuel, it burned without producing any useful effect, for which there are two reasons; one, that on account of obstructed air supply through the fuel bed, incomplete combustion and escaping hydrocarbons carried away a portion of the heat, because the gases passed immediately among the tubes of the boiler. The other is, that owing to the presence of an excess of ash, the percentage of fuel on the rear portion of the grate is greatly reduced. On this account a larger proportion of the air passing through the fuel bed does not combine with the fuel, but enters the furnace as free air. As the prime function of a furnace is to heat the gases passing through it, any increase in the amount of air entering the furnace without a corresponding increase in the amount of fuel burned must result in a lowering of the furnace temperature.

This lowering of temperature, besides making a long, smoky flame which reaches up among the boiler tubes and is there chilled to below the burning point, also reacts on the fuel bed, reducing the rate of combustion and still further increasing the adulteration of the furnace gases with free air. When the temperature of the furnace has been thus reduced to about 600 degrees Fahrenheit the boiler is unable to absorb any more heat than is necessary to make up for radiation losses.

It will be observed that the points on the diagram do not fall in symmetrical order. This is particularly true of ash percentages of about thirty-four, which may be explained by the refuse used in these tests being probably of a more fusible character than with others. These tests with the ash composition were made with the smaller boiler above mentioned.

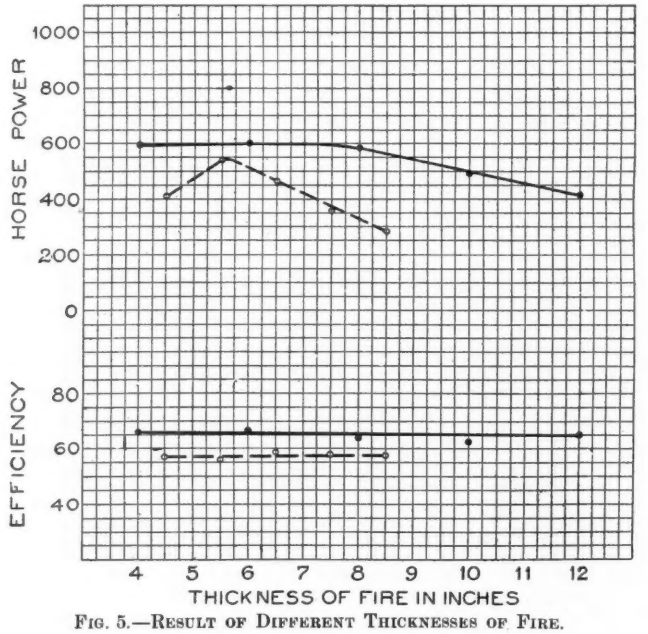


FIG. 5.—RESULT OF DIFFERENT THICKNESSES OF FIRE.

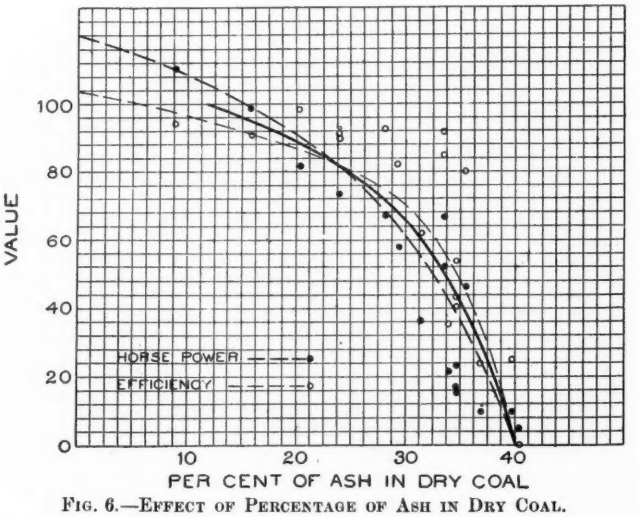


FIG. 6.—EFFECT OF PERCENTAGE OF ASH IN DRY COAL.

EFFECTS OF VARIATION IN SIZE OF COAL SCREENINGS..

In Illinois and Indiana coal not sold as mine run is separated largely as lump and screenings, and such screenings furnish

about ninety per cent of the stoker fuel used in Illinois.

The diagrams (Figs. 3 and 4) illustrate the result of sixty-two tests. With each the size of coal as measured by screens with square openings ranging in dimensions from 0.25 to 1.50 inches, advancing by 0.25 inch, and the average sizes of coal as shown at the base of the diagrams, were calculated from sizing tests made with these screens and represent the dimension in fractions of an inch of openings in a screen which would allow one-half of the coal to pass through and the other half to go over the screen, and it is this that is designated as its average size.

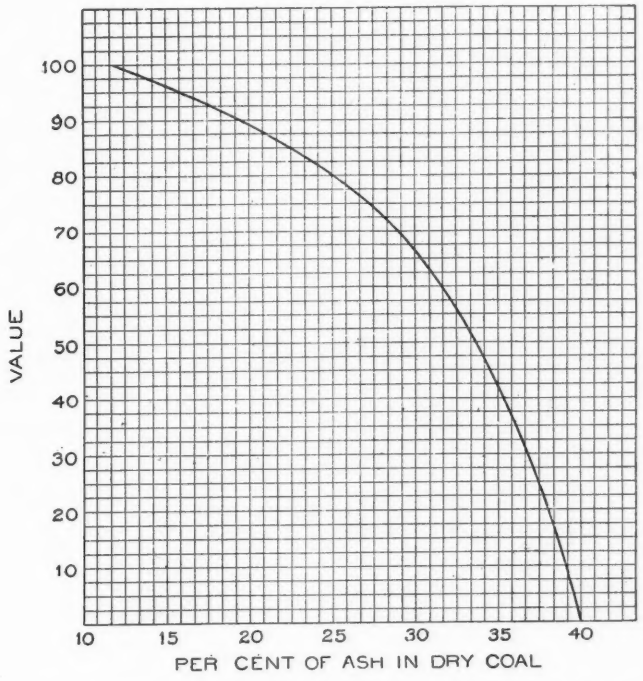


FIG. 7.—VALUE OF FUEL WITH REFERENCE TO PERCENTAGE OF ASH.

In diagrams, Fig. 3 shows the effect produced on horse-power output owing to this variation in size of the coal, and Fig. 4 illustrates the resulting efficiency from the same cause and for the same tests.

The curves for both efficiency and capacity drop midway between the tests with both small and large coal. This is a peculiarity which may be explained as follows: Performance becomes better as the size of coal increases, until a point is reached when the quantity of large pieces becomes so great that there is not enough fine material to properly close the interstices between, with the result that performance drops off, due to excess of air, until a condition is reached when all of the pieces of fuel approach uniformity, when owing to greater agreement in size, they fit together better, and in a measure produce a homogeneous mass similar to that secured by the fine dust filling the spaces in the fuel bed in the first case.

The presence of fine dust in excess is a great and important source of trouble. Referring to Fig. 1, coal through a 0.25 inch square screen produced only 108 horse-power, yet a size of fuel known in Illinois as No. 5 washed coal, which will pass through a 0.25-inch round hole (a smaller aperture than the square opening) will produce as high as 600 horse-power under the same boiler. It is true that the lower ash content of the washed coal has a considerable influence, but this is offset by the larger size of the square screen as against the round one.

To arrive at a better understanding of the physical make-up of these two characters of fuel, tests were made of the dust of each, using that quantity which would pass through a twenty-mesh screen, with the results shown in table A.

TABLE A.

QUANTITY AND SIZE OF COAL DUST BELOW TWENTY-MESH SCREEN.

Per Cent of Different Sizes.

Dust Sample.	Through 20 and over 40.	Through 40 and over 60	Through 60 and over 80.	Through 80 and over 100.	Through 100.
No. 5 washed	63.36	16.78	6.51	2.93	10.42
Duff through one-quarter-inch square screen	46.10	13.87	8.18	3.84	28.01
Average of five tests from ordinary screenings	48.50	13.78	7.57	4.38	25.74

The quantity of the extremely fine dust through the 100-mesh screen is shown to be almost three times as much in the unwashed as with the washed coal. The third line of the table is an average from five tests taken from different lots of screenings, and it shows an approximate agreement with the quantities from the dust through the one-quarter-inch square screen, from which it follows that the presence of the fine dust has an enormous influence on the burning of the fuel.

RESULT OF DIFFERENT THICKNESS OF FIRE.

An excess of air accompanies a thin fire, and because of it, efficiency produced through the boiler is affected. On the other hand, a thick fire reduces the excess of air, but increases the volume of hydrocarbon gases which leaves the surface, or in other words, makes more smoke. If a furnace is located between the boiler and stoker, these gases will be burned, otherwise they will largely escape among the tubes of the boiler as they did in this case. Therefore, under these conditions, a thin fire increases the loss due to excess of air, but decreases that due to smoke and incomplete combustion. On the other hand, a thick fire reduces the excess of air, but increases the smoke and escaping combustible gas, and so the best thickness of fire may be a matter of importance. With this type of boiler of a height of nine tubes when served with chain-grate stokers discharging immediately among the tubes, it is always most economical to produce as large a volume of smoke as possible with the coal being used. With boilers of fourteen tubes in height, the conditions are different, because such boilers are more efficient.

With an ideal boiler the final temperature would be the same as the atmosphere, therefore an unlimited excess of air could be used without causing heat loss. No practical boiler can, of course, be an ideal one, but the Babcock & Wilcox type of fourteen tubes high approaches much nearer to it than does one of nine high, and for that reason is more efficient, and in this connection is quite unique, as Fig. 5 will show.

The curves of efficiency in this diagram illustrate a constant heat efficiency produced through the boiler for a full working range in thickness of fire, insuring not only maximum excess of air, but incomplete combustion loss as well, yet the efficiency remained uniform, and the only

opportunity for the "skillful' and "intelligent" fireman is in selecting that thickness best suited to capacity requirements.

The coal used in these two series of tests was very uniform in size and ash content, and for these reasons was well suited to the purpose of experiments. In the series with thickness of fire, from 4.5 to 8.5 inches, what is known as No. 5 washed coal was used, a size which passes through a screen having round openings 0.25 inch in diameter. With the other series and a larger range in thickness, washed screenings were employed.

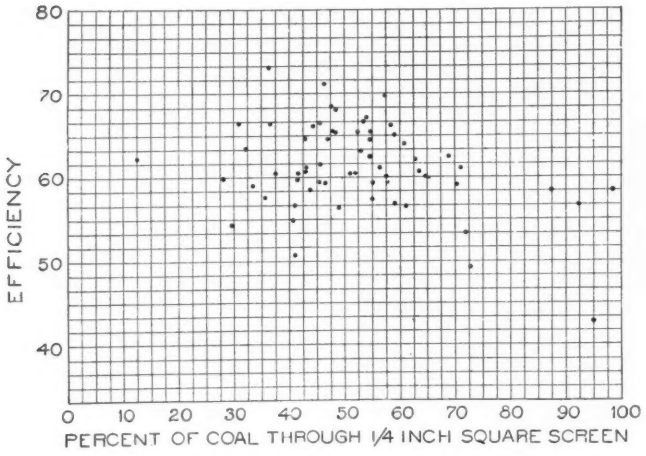


FIG. 8.—EFFECT ON EFFICIENCY OF SCREENED COAL.

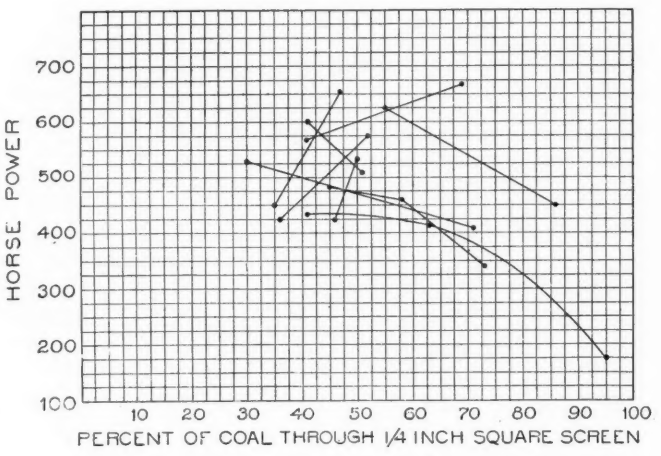


FIG. 9.—EFFECT ON HORSE POWER OF SCREENED COAL.

TABLE SHOWING VALUE OF SCREENINGS.

Table B gives values in one figure for screenings containing different percentages of ash, and of variation in size as measured by that portion passing through a 0.25-inch round screen. The following detailed statement explains how this table was prepared:

The value of coal screenings is affected by four variables, which are heating power, moisture, ash and size of the pieces of coal. Heating power in Illinois and Indiana of the pure coal—in other words, free from ash and moisture, the real coal—ranges from 13,800 as the minimum to a maximum of 14,500 British thermal units per pound, and moisture from about nine to fourteen per cent. These two characteristics, however, are of minimum importance, as either can affect the result by only a comparatively small amount. With the other two features, amount of ash and size of the pieces, each may exert an influence of such moment that they cause the fuel to be valueless. Thus, in fuel inspection service it may be necessary to test only the latter characteristics, therefore table B is based on variation in per cent of ash and on size of the coal, moisture and heating power being assumed as constant.

The fuel in service under a boiler produces two results, one of efficiency and the other of capacity, and capacity, or in other words, quantity of steam produced, is a matter of great importance. Therefore, if these two effects may be averaged and treated as a single value, the problem is much simplified.

Inspection of diagrams Figs. 3 and 4 shows that resulting capacity and efficiency are approximately the same, and that the condition of fuel which results in a high efficiency also produces large capacity. This makes it possible to assign two values to the fuel, one applying to ash content, the other to its size, each of these values embracing efficiency and capacity as a unit.

In placing the effect due to ash in shape for use in preparation of table B, diagram Fig. 6, which is a reproduction of Fig. 2, has a heavy curve drawn midway between those of efficiency and capacity. This average curve represents the value of the fuel as far as ash is concerned, which appears to be 100 per cent, with twelve per cent of ash in the dry screenings, and according to this, value could be greater than 100 per cent, but twelve per cent represents an average minimum ash content for coal screenings in Illinois and Indiana at the present time, therefore

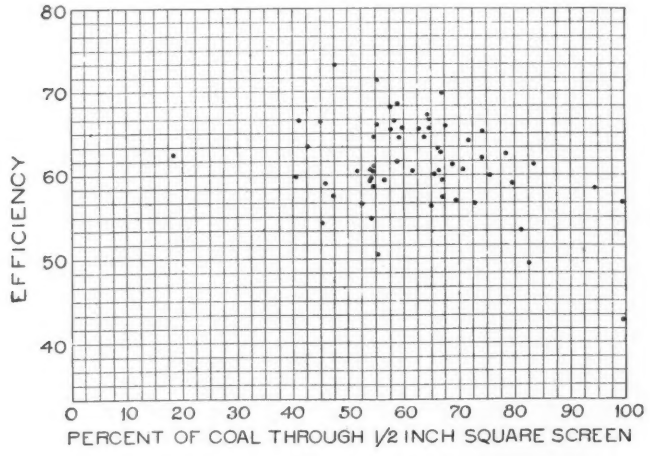


FIG. 10.—EFFECT ON EFFICIENCY OF SCREENED COAL.

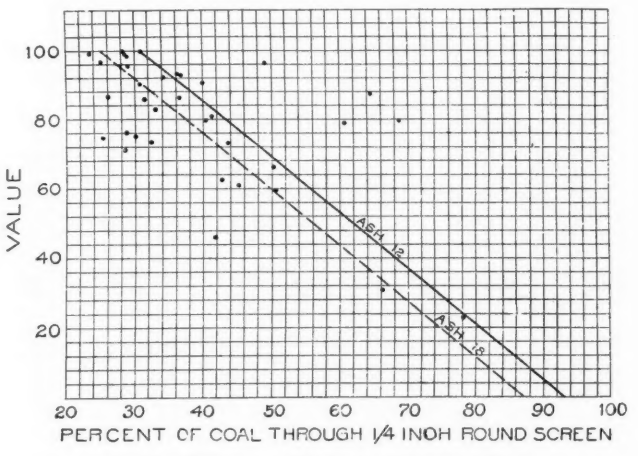


FIG. 11.—EFFECT ON VALUE OF SCREENED COAL.

such fuel is the best obtainable, and for this reason may have a value of 100 per cent assigned to it.

Thus Fig. 7 contains a curve showing value taken from Fig. 6, and without the complication of curves and points in the latter, and ash values were taken directly from it for use in the compilation of table B.

The feature of size is a more difficult problem than that of ash, as the following will show. After the tests represented in diagrams Figs. 3 and 4 (sixty-two in number) were finished, Fig. 8 was plotted, using percentages of coal through a 0.25-inch square screen. The diagram for efficiency only is shown, because that for capacity gave no different result. It is apparent that the arrangement of points fails to show any harmful effect due to presence of excessive quantity of fine dust. The fuel used in these sixty-two tests was ordinary screenings, containing varying amounts of ash, and to ascertain if this variable ash content could be the cause of the failure of Fig. 8 to show harmful effect of fine dust, individual tests were used in the plotting of Fig. 9, the ash content for the tests shown by any one of the curves being constant, while the size as represented by the percentage through the 0.25-inch square screen varied. The result of this analysis made it appear that the presence of finer sizes was sometimes harmful, and in other cases beneficial. The scheme of average size was then adopted and employed, with the result shown by diagrams Figs. 3 and 4, described in the first division of this paper, and as a check on the conclusions of these two diagrams, Fig. 10 was plotted, based on percentages through a 0.5-inch screen. With 1.25-inch screenings, this size is nearer to the general average than that of 0.25-inch, and it is apparent that a curve may be drawn through the points which will show a falling off in efficiency or capacity with increase in quantity of fuel through the 0.5-inch screen, which helps to corroborate the conclusions of Figs. 3 and 4.

In coal inspection service, it is quite essential that the tests be simple and few in number, but determination of the average size requires that several screens be employed, involving a large amount of work, as well as difficult calculation, and for this reason there is great advantage in using but one screen. The 0.25-inch size having received more of less favorable consideration in working out a scheme for its use in connection with table B, all of the tests which showed a capacity below 575 horse-power were taken. With these data Fig. 11 was prepared. The average ash in the dry coal for these tests was eighteen per cent. A curve representing values for this ash content, and also for standard ash of twelve per cent being drawn, the latter curve gave values for use in table B. The quantities of coal were transposed from that through the 0.25-inch square to a 0.25-inch round screen. Thus the final result for ash shown by diagram Fig. 7 and that for size by diagram Fig. 11, furnished data used for calculating the final combined values in table B, from which it appears that screenings having twelve per cent of ash or less, and of a size that no more than thirty-one per cent will pass a 0.25-inch round screen, may be considered of 100 per cent value, or in other words, sufficiently good for the purpose.

Basing conclusions on the measurement given by any one screen is arbitrary, as four points in diagram Fig. 11 indicate; therefore, while table B may be depended on to identify all of the coal containing an excess amount of fine sizes, it will, in a few cases, condemn satisfactory fuel.

This paper does not presume to lay down the ultimate laws by which fine coals may be graded in value, but rather to point out the fact that such laws, although at present obscure, do exist, and

PERCENT OF ASH IN DRY COAL

PERCENTAGE OF COAL THROUGH 1/4-INCH ROUND SCREEN

	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
31	100	99	98	96	95	94	92	91	89	88	86	84	82	80	78	76	73	70	67	63	58	53	48	42	35	28	20	10	0
32	98	97	96	94	93	92	90	89	87	86	84	82	80	78	76	74	71	68	65	61	56	51	46	40	33	26	18	9	
33	96	95	94	92	91	90	88	87	85	84	82	80	78	76	74	72	69	66	63	59	54	49	44	38	31	24	16	6	
34	94	93	92	90	89	88	86	85	83	82	80	78	76	74	72	70	67	64	61	57	52	47	42	36	29	22	14	4	
35	93	92	91	89	88	87	85	84	82	81	79	77	75	73	71	69	66	63	60	56	51	46	41	35	28	21	13	3	
36	91	90	89	87	86	85	83	82	80	79	77	75	73	71	69	67	64	61	58	54	49	44	39	33	26	19	11	1	
37	90	89	88	86	85	84	82	81	79	78	76	74	72	70	68	66	63	60	57	53	48	43	38	32	25	18	10		
38	88	87	86	84	83	82	80	79	77	76	74	72	70	68	66	64	61	58	55	51	46	41	36	30	23	16	8		
39	87	86	85	83	82	81	79	78	76	75	73	71	69	67	65	63	60	57	54	50	45	40	35	29	22	15	7		
40	85	84	83	81	80	79	77	76	74	73	71	69	67	65	63	61	58	55	52	48	43	38	33	27	20	13	5		
41	83	82	81	79	78	77	75	74	72	71	69	67	65	63	61	59	56	53	50	46	41	36	31	25	18	11	3		
42	82	81	80	78	77	76	74	73	71	70	68	66	64	62	60	58	55	52	49	45	40	35	30	24	17	10	2		
43	80	79	78	76	75	74	72	71	69	68	66	64	62	60	58	56	53	50	47	43	38	33	28	22	15	8			
44	78	77	76	74	73	72	70	69	67	66	64	62	60	58	56	54	51	48	45	41	36	31	26	20	13	6			
45	77	76	75	73	72	71	69	68	66	65	63	61	59	57	55	53	50	47	44	40	35	30	25	19	12	5			
46	75	74	73	71	70	69	67	66	64	63	61	59	57	55	53	51	48	45	42	38	33	28	23	17	10	3			
47	74	73	72	70	69	68	66	65	63	62	60	58	56	54	52	50	47	44	41	37	32	27	22	16	9	2			
48	72	71	70	68	67	66	64	63	61	60	58	56	54	52	50	48	45	42	39	35	30	25	20	14	7				
49	71	70	69	67	66	65	63	62	60	59	57	55	53	51	49	47	44	41	38	34	29	24	19	13	6				
50	69	68	67	65	64	63	61	60	58	57	55	53	51	49	47	45	42	39	36	32	27	22	17	11	4				
51	67	66	65	63	62	61	59	58	56	55	53	51	49	47	45	43	40	37	34	30	25	20	15	9	2				
52	66	65	64	62	61	60	58	57	55	54	52	50	48	46	44	42	39	36	33	29	24	19	14	8	1				
53	64	63	62	60	59	58	56	55	53	52	50	48	46	44	42	40	37	34	31	27	22	17	12	6					
54	62	61	60	58	57	56	54	53	51	50	48	46	44	42	40	38	35	32	29	25	20	15	10	4					
55	61	60	59	57	56	55	53	52	50	49	47	45	43	41	39	37	34	31	28	24	19	14	9	3					
56	59	58	57	55	54	53	51	50	48	47	45	43	41	39	37	35	32	29	26	22	17	12	7	1					
57	58	57	56	54	53	52	50	49	47	46	44	42	40	38	36	34	31	28	25	21	16	11	6						
58	56	55	54	52	51	50	48	47	45	44	42	40	38	36	34	32	29	26	23	19	14	9	4						
59	54	53	52	50	49	48	46	45	43	42	40	38	36	34	32	30	27	24	21	17	12	7	2						
60	53	52	51	49	48	47	45	44	42	41	39	37	35	33	31	29	26	23	20	16	11	6	1						
61	51	50	49	47	46	45	43	42	40	39	37	35	33	31	29	27	24	21	18	14	9	4							
62	49	48	47	45	44	43	41	40	38	37	35	33	31	29	27	25	22	19	16	12	7	2							
63	48	47	46	44	43	42	40	39	37	36	34	32	30	28	26	24	21	18	15	11	6	1							
64	46	45	44	42	41	40	38	37	35	34	32	30	28	26	24	22	19	16	13	9	4								
65	45	44	43	41	40	39	37	36	34	33	31	29	27	25	23	21	18	15	12	8	3								
66	43	42	41	39	38	37	35	34	32	31	29	27	25	23	21	19	16	13	10	6	1								
67	41	40	39	37	36	35	33	32	30	29	27	25	23	21	19	17	14	11	8	4									
68	40	39	38	36	35	34	32	31	29	28	26	24	22	20	18	16	13	10	7	3									
69	38	37	36	34	33	32	30	29	27	26	24	22	20	18	16	14	11	8	5	1									
70	37	36	35	33	32	31	29	28	26	25	23	21	19	17	15	13	10	7	4										
71	35	34	33	31	30	29	27	26	24	23	21	19	17	15	13	11	8	5	2										
72	33	32	31	29	28	27	25	24	22	21	19	17	15	13	11	9	6	3											
73	32	31	30	28	27	26	24	23	21	20	18	16	14	12	10	8	5	2											
74	30	29	28	26	25	24	22	21	19	18	16	14	12	10	8	6	3												
75	28	27	26	24	23	22	20	19	17	16	14	12	10	8	6	4	1												
76	27	26	25	23	22	21	19	18	16	15	13	11	9	7	5	3													
77	25	24	23	21	20	19	17	16	14	13	11	9	7	5	3	1													
78	24	23	22	20	19	18	16	15	13	12	10	8	6	4	2														
79	22	21	20	18	17	16	14	13	11	10	8	6	4	2															
80	20	19	18	16	15	14	12	11	9	8	6	4	2																
81	19	18	17	15	14	13	11	10	8	7	5	3	1																
82	17	16	15	13	12	11	9	8	6	5	3	1																	
83	16	15	14	12	11	10	8	7	5	4	2																		
84	14	13	12	10	9	8	6	5	3	2																			
85	12	11	10	8	7	6	4	3	1																				
86	11	10	9	7	6	5	3	2																					
87	9	8	7	5	4	3	1																						
88	7	6	5	3	2	1																							
89	6	5	4	2	1																								
90	4	3	2																										
91	3	2	1																										
92	1																												
93	0																												

TABLE B.—COAL VALUES FOR SCREENINGS.

that our conclusions drawn from numerous tests are as herein indicated.

During the year 1905 there was produced in Illinois and Indiana about 50,000,000 tons of coal, forty-eight per cent of which was one and one-quarter-inch screenings, and although it was not in every case separated from the lump, we can truthfully say that this forty-eight per cent, or 20,000,000 tons of screenings, was sold at the mine at an average price not to exceed two-thirds of its cost of production, and this same fine coal was used for making steam at an average efficiency of less than fifty per cent.

These two facts are sufficient warrant for further investigation of this little-known subject.

High-Efficiency Lighting Units in Ohio.

One of the most interesting subjects of discussion at the recent convention of the Ohio Electric Light Association, at Put-in-Bay, was the progress made in introducing the newer forms of electrical illuminating units in Ohio. In a paper entitled "High-Efficiency Lighting Units in Ohio," C. C. Collins, of the Columbus Railway and Light Company, presents an analysis of the situation.

While referring *en passant* to the flaming arc and the Nernst lamps as among recent improvements, he treats more especially of the Gem-filament incandescent lamp. He thinks the improvements in the incandescent field are more welcome than in other units, since the incandescent constitutes the greater portion of the central station load and source of revenue. The writer deplores the timid policy of clinging to the older types of lamps for fear that sufficient revenue may not be secured by the introduction of a better lamp, and believes that to be governed by such a policy is to invite discontent, competition and perhaps legislation. On the other hand, the adoption of a liberal policy will cause the consumer to increase his lighting and outshine his neighbor, who in turn will retaliate and thus the sum total of consumption be largely increased. The writer doubts if any community has been worked so hard that it will be impossible to further increase its lighting demands. It is also possible in many cases to substitute in existing installations a lamp of higher candle-power but consuming the same amount of energy, thus making friends for the central station in satisfied customers. No improvement is too good for your customer if you would retain him when reverses set in in the way of competition with other as well as with electrical illuminants. The writer mentions with commendation the new factory markings of the Gem lamp, explaining that this method of marking is intended to measure the degree of useful light rather than the candle-power, technically speaking, about which the average consumer knows very little, accurately speaking. A direct comparison of illuminants is probably the best method of convincing the public of the merits of one illuminant over another. This can be done either on customer's premises, or in a display room owned by the central station. By this method all the effects of reflectors, globes for filtering out objectionable colors, general diffusing properties, etc., can be taken into full account. The customer sees that he is buying light, not candle-power nor kilowatts, and can see for himself what he is going to get. Such a display room can be made invaluable. Great care should be taken in the selection of reflectors. The high-efficiency Gem lamp and its shade must be used together as a unit. It is generally used with one of two shades, the concentrating and diffusing, which are so designed that they give an even distribution of light over a specified area. The source of light is distributed over a much larger area than with the arc lamp, the Nernst lamp and the flaming arc, when used at their maximum efficiency, that is, without dense globes. The Gem large size, although not equal to the arc in efficiency, is far better suited where ceilings are low, and in every case where clusters are now used. The writer then makes a comparison illustrating this position. A strong point is that the customer is able to increase his lighting with no additional wiring, as the Gem can be taken on without any change in existing installations. A number of companies are at present making fixtures suitable for the Gem lamp and at very reasonable prices. All incandescent lamps should be used with shades, and their selection is a matter of considerable importance, and should have an eye to giving proper distribution always. A wide difference will be found in shades with respect to their evenly distributing the light and their absorption. An arc lamp, preferably the direct current, should be used where it is essential to show the daylight color of an article; but where color is of little consequence, or white light is not so effective as a light rich in red or yellow rays, the Gem can be used to great advantage. Articles sold should be so far as possible displayed under light similar to that with which they will be used; for example a rug or piece of carpet. In lighting large stores or halls a combination of arc and Gem lamps gives very good results, and is probably the most efficient method. Where the ceilings have a height of less than ten feet, in rooms too small for an arc lamp, in show-windows, offices, stores with hangings, porches, etc., the Gem lamp with its proper shades will be found entirely feasible. The Gem lamp is recommended to all lighting companies as being in sizes of 250 watts or less the best lamp obtainable at the present time. It may at first be put out as a specialty until it has proved its feasibility to the customer, and then be adopted as standard. There is no reason why the fifty-watt, twenty-candle-power size should not be used to displace all carbon-filament sixteen-candle-power lamps. For lighting companies whose regulation will not permit the use of 3.1 watt carbon-filament lamps the Gem can be used at either its middle or bottom voltage, and still give an efficiency of 2.65 or 2.8 watts per candle. The writer, in summing up, expresses his belief that the tantalum lamp is not yet in a commercial form, owing to its high initial cost, and further should be used only on direct current. On account of the method of suspending the filament the lamp can only be burned in a vertical position, on account of the danger of rupturing the filament.

The International Independent Telephone Association of America.

The general offices of the International Independent Telephone Association of America have been moved from the rooms formerly occupied to 422 and 423 Electric Building, Cleveland, Ohio.

The following committees have been appointed by the president:

Executive committee—Senator C. W. Kline, Hazleton, Pa.; Frank L. Beam, Columbus, Ohio; A. C. Lindemuth, Richmond, Ind.; M. B. Overly, Louisville, Ky. The constitution provides that the president shall be an *ex officio* member and chairman of this committee.

Committee on litigation and legislation —J. B. Earle, Waco, Tex.; F. H. Woods, Lincoln, Neb.; E. R. Conklin, Aurora, Ill.; E. B. Fisher, Grand Rapids, Mich.; Richard Valentine, Janesville, Wis.

The Frankfort Central Station.

A Large German Municipal Power Plant.

By B. F. Hirschauer.

AMONG the municipal plants which are in successful operation on the Continent may be mentioned the large station which has been erected within a recent period at Frankfort. It ranks among the best-equipped of the German plants. Most of the equipment consists of alternator groups using horizontal engines, but a late addition to the station is a large steam turbine and alternator unit of the Brown-Boveri-Parsons type. All the alternators are operated on the single-phase system, and the feeders which leave the station for use throughout the city, carry the standard tension of 3,000 volts at forty-five cycles, coming direct from the alternators. The present equipment of the plant consists of four direct-coupled units made up of tandem-compound engines driving 1,030-kilowatt Brown-Boveri alternators, and four smaller units of the same general design, rated at 530 kilowatts, besides the steam turbine group, which has a capacity of 3,000 kilowatts. The alternators deliver the same voltage in all cases, and are operated in parallel when desired, including the machine belonging to the steam turbine group.

The general disposition of the buildings will be observed in the accompanying plan, which shows the main dynamo hall, the boiler room and the coal bunkers. The dynamo room is about 300 feet long and ninety feet wide, and contains nine direct-coupled engine and dynamo groups of different sizes and construction. Lying next the dynamo hall is a large and well-equipped boiler room, which is somewhat longer than the first portion of the building. At each end of the boiler room is mounted a battery of six boilers of German make, and besides these two, there has been mounted a battery of three boilers, making fifteen boilers for the whole outfit. The remaining space is occupied by feed-water heaters, superheaters, pumps and other apparatus. Facing the boilers is the building occupied by the coal bunkers, which is thirty-six feet in width. As the station building lies not far from the river, the coal can be easily brought into the premises from the barges. This is carried out by a well-designed set of conveyors combined with cranes for unloading the coal from the boats, so that the coal is taken directly into the bunkers. At each end of the boiler house is a smoke-stack of 170 feet height.

As regards the boiler plant of the Frankfort station, it is made up of fifteen boilers in all, mounted as we have seen in two separate batteries of six boilers each, and one battery containing three boilers. Six boilers of the Simonis and Lanz pattern make up the first battery, and these units have a heating surface of 380 square yards each and a fire-grate surface of about 5.5 square yards. The second battery is formed of six Cornwall boilers of the G. Kuhn type, constructed by the Steinmüller firm. Each of these units has some 100 square yards heating surface. The third battery is made up of boilers of a large size, also of the G. Kuhn type. They have a heating surface of 480 square yards. Mechanical stoking apparatus of the Leach system is used in the boiler plant. In general running, the batteries of boilers just mentioned are called upon to furnish some 70,000 pounds of steam, superheated at 300 degrees centigrade.

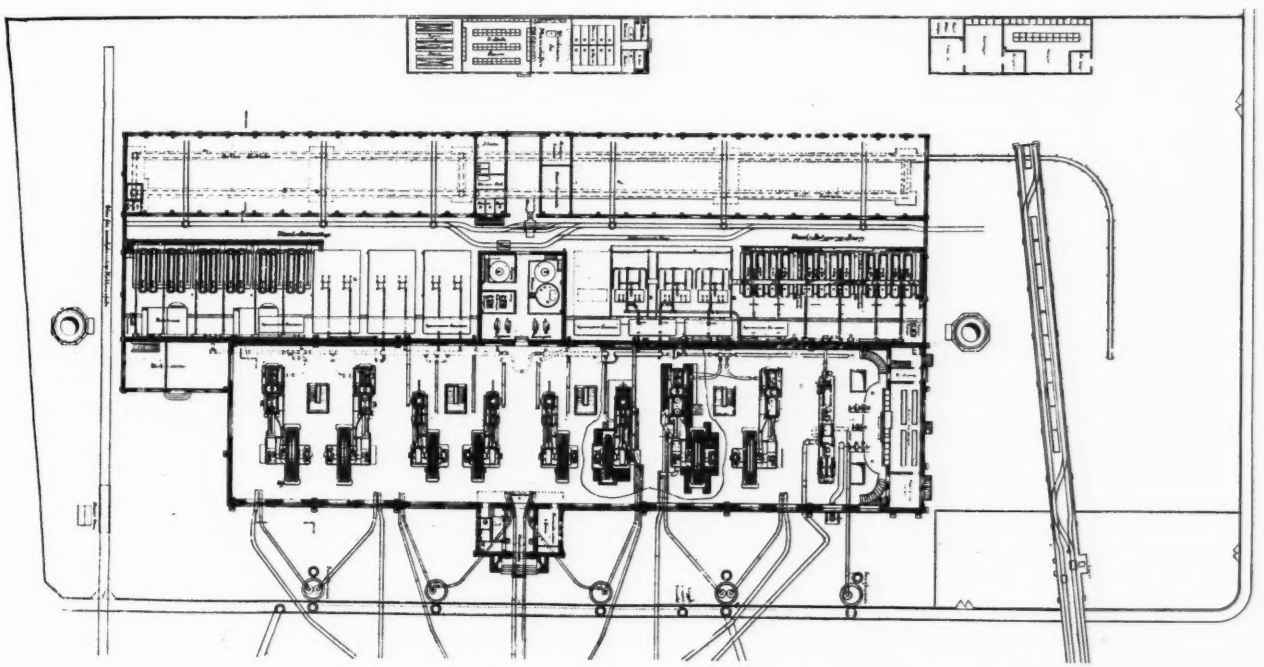


FIG. 1.—PLAN OF FRANKFORT CENTRAL STATION.

In connection with the boiler outfit just mentioned, the plant is equipped with two superheaters of the Steinmüller pattern, which are mounted overhead. Each of the superheaters contains a set of 220 horizontal heating tubes and has a total heating surface of 350 square yards.

The main dynamo room contains nine direct-coupled units in all. These are made up of eight engine-and-dynamo

groups and one steam turbine group. For the former units, two different sizes of machines are used. The four larger groups are made up of 1,030-kilowatt alternators driven by horizontal engines, while in the central part of the building we find four groups of smaller size. The latter consist of 530-kilowatt alternators, also driven by engines of the horizontal type. Engines of two different makes are used in the station. For the smaller groups we find a 570-horse-power engine of the G. Kuhn pattern in use. It is one of the best-known types of German compound engines, and can be run as high as 750 horse-power on a maximum load. The engine is tandem compound. A governor is mounted upon the high-pressure cylinder, while the low-pressure system is invariable. The high-pressure cylinder has a bore of twenty-five inches, and the low-pressure cylinder thirty-eight inches. Both cylinders are steam-jacketed. The piston stroke is forty-eight inches. The condenser pump, which is placed in the basement underneath the engine, is driven by a transmission from the outer end of the engine shaft. Three bearings are used to support the latter.

Upon the engine shaft is mounted a heavy flywheel, which serves at the same time as the support for the field magnets of the alternator. A slotted ring, built up of laminated iron, surrounds the field in the usual way. The alternators have been constructed by the well-known Swiss firm, Brown, Boveri and Company, at their Baden factory, and they are designed to furnish single-phase current at 3,000 volts when running at the normal engine speed of eighty-five revolutions per minute. Around the periphery of the flywheel are mounted sixty-four pole-pieces of solid iron. These pole-pieces are fixed to the wheel rim in such manner that they can be easily removed. On the pole-pieces is laid a winding of flat and thin copper strip, with the layers separated by paper insulation. As to the weight of the flywheel proper, it is about thirty tons, and has a diameter of sixteen feet, exclusive of the pole-pieces. Around the field which is thus formed is placed the armature ring, which is made up of a circular casting built in four parts and bolted together, and containing the armature iron proper. The latter consists of sixteen segments of laminated iron. Upon each segment is mounted a winding in the form of four lathe-wound coils which are placed in the slots in the usual way. The coils can be readily removed from the slots when desired, owing to a special method of construction which is used here. At the above-mentioned speed, the alternator is made to furnish 45.3 cycles. On the outer end of the main shaft is mounted a direct-current machine of some size, which serves as the exciter for the alternator. It is a six-pole machine and furnishes a current of eighty volts and 190 amperes. The current is taken into the alternator field by a two-ring collector mounted on the shaft. The four direct-coupled groups of 530 kilowatts form the outfit which was set up during the first period of operating the Frankfort station. As the demand for current increased, it was decided to erect four other groups of a somewhat similar character, but of a much larger size, and in fact the latter groups have nearly double the capacity of those we have just mentioned.

The new outfit is made up of four groups of 1,050-kilowatts capacity, shown in Fig. 2. In the ground plan, Fig. 1, are seen two of the large groups placed on each side of the four smaller sets in the dynamo room. The engines are also of the tandem-compound type and in this case they have been furnished by the Swiss firm of Sulzer Brothers, of Winterthür. A maximum capacity of 1,500 horse-power is given by the engines, and they use superheated steam at 250 degrees centigrade and at a pressure of nine atmospheres. A characteristic point of the engine is the arrangement of the high and low-pressure cylinders. The low-pressure cylinder is mounted next the cross-head of the piston rod, so that the latter will not become unduly heated, and the high-pressure cylinder which carries the highest heat, is separated from the former by a cast-iron connecting piece, so as to isolate it to some extent. The live steam for the engine is made to enter directly from the piping into the steam jacket before going to the cylinders. Upon each of the cylinders is mounted four valves. The inlet valves of the high-pressure cylinder are operated by means of a special form of governor. A pneumatic device connects the governor with a lever upon the switchboard, so that the machinist can vary the speed of the engine from this point.

Upon the shaft of the engine is mounted a single-phase alternator of 1,050 kilowatts maximum capacity. These machines have also been furnished by the Brown-Boveri firm, and in their construction they follow very closely the lines of the alternators which we have already described. Here the flywheel, which is mounted upon the engine shaft, weighs about sixty-five tons and has a diameter of twenty feet. Around the periphery of the flywheel is placed a set of sixty-four field poles which have a copper-strip winding. On the outer end of the shaft is mounted an eight-pole exciter. The cable from the exciter passes through the engine shaft, which is made hollow for the purpose, directly to the terminals of the field, thus dispensing with the collector rings.

As regards the steam consumption of the engines, we find that in the case of the smaller 570-horse-power engines above mentioned, the tests showed that for a normal load of 560 horse-power the engines consumed 25.9 pounds of steam per kilowatt-hour as indicated upon the switchboard. For the maximum load of 750 horse-power, the amount is 26.8 pounds per kilowatt-hour.

An interesting feature of the Frankfort station is the steam-turbine dynamo which has been installed by the Brown-Boveri company. This group will be noticed in the foreground of Fig. 2, and also in the plan view (Fig. 1). It is erected at one end of the dynamo room, beside the engine groups. The turbine is of the two-cylinder form of the Brown-Boveri-Parsons type, and is coupled direct to an ironclad alternator of 2,600 kilowatts. Superheated steam at 300 degrees centigrade is used to operate it, using a pressure of thirteen atmospheres. In this form of turbine the high and low-pressure wheels are placed in separate chambers, with the shafts coupled together in the centre by an intermediate bearing and clutch. But in the more recent forms of wheel the two turbines are built directly together without using a middle space, and having only the two bearings mounted at the ends. This makes the turbine considerably shorter. Aside from this, the present turbine contains the usual features of the Brown-Boveri system.

The high-pressure turbine contains three separate chambers of increasing diameter. The smallest of the wheels mounted on the main shaft contains eleven disks, the second has nine disks, while the largest wheel has eight disks. The second or low-pressure part of the turbine is provided with two wheel-chambers. In the first chamber, having the smaller diameter, there is one set of ten disks, while the second chamber contains a four-disk wheel. Connecting the high-pressure and low-pressure systems is a pipe of large diameter, which passes underneath the central bearing. Four bearings are used for the entire group of turbine and alternator. The bearings of the turbine proper are designed as self-oiling ball bearings, and the outer part of the bearing is cooled by a water circulation, using a water pump which de-

livers fifty gallons per minute, so as to give an efficient cooling. Between the two halves of the turbine is placed a specially designed bearing which is combined with a clutch in such a way that it is an easy matter to uncouple the shafts of the two wheels in order to separate them when desired. A good lubricating system is employed for the bearings of the present group. From an oil tank placed in the basement underneath the foundation, a turbine pump operated from the main shaft by a worm gearing takes up the oil and passes it through a cooling box and from thence it is taken to the different bearings by a set of piping. The water which has previously cooled the bearings is made to pass from thence into the oil cooler box through an appropriate piping. By means of the oil pump, the bearings are well lubricated by a constant circulation. A steam pump is provided which serves as a reserve in case of need.

In practice it is found that the steam turbine group runs at a very regular speed and on this account no trouble is experienced in running it in parallel with the other alternators of the station. This is partly due to the method which has been adopted by the Brown-Boveri company in the construction of the alternator. Here the revolving field of the machine is built upon the lines of the rotor of a non-synchronous motor. As will be noticed, the alternator is almost entirely enclosed, except for a set of ventilating holes. Current is brought into the revolving field by a set of collector rings provided with carbon brushes. The present machine is built for a capacity of 2,600 kilowatts under the regular load, in which case the power-factor is 0.8. At the maximum load the capacity rises to 3,000 kilowatts. The normal speed of the turbine is 1,360 revolutions per minute. Although the length of this group is somewhat above what we find in the turbines which do not employ the central bearing, it does not exceed reasonable limits, and is here about fifty feet over all, with a width of eight feet. The exciting current for the revolving field of the alternator is furnished at 120 volts from two rotary groups which have been installed in the dynamo room. These groups serve to convert the high-tension alternating current from the main bars into low-tension direct current. Each of the rotary groups has a capacity of fifty kilowatts. The station contains a large outfit of accumulators, which is mounted in a special room adjoining the dynamo hall. A reserve supply of current is always at hand in this case. The storage battery consists of sixty-seven large cells, and has a capacity of 920 to 1,300 ampere-hours at a three-hour discharge rate. A special group has been installed in the plant for charging the storage battery, consisting of a rotary converter rated at fifteen kilowatts.

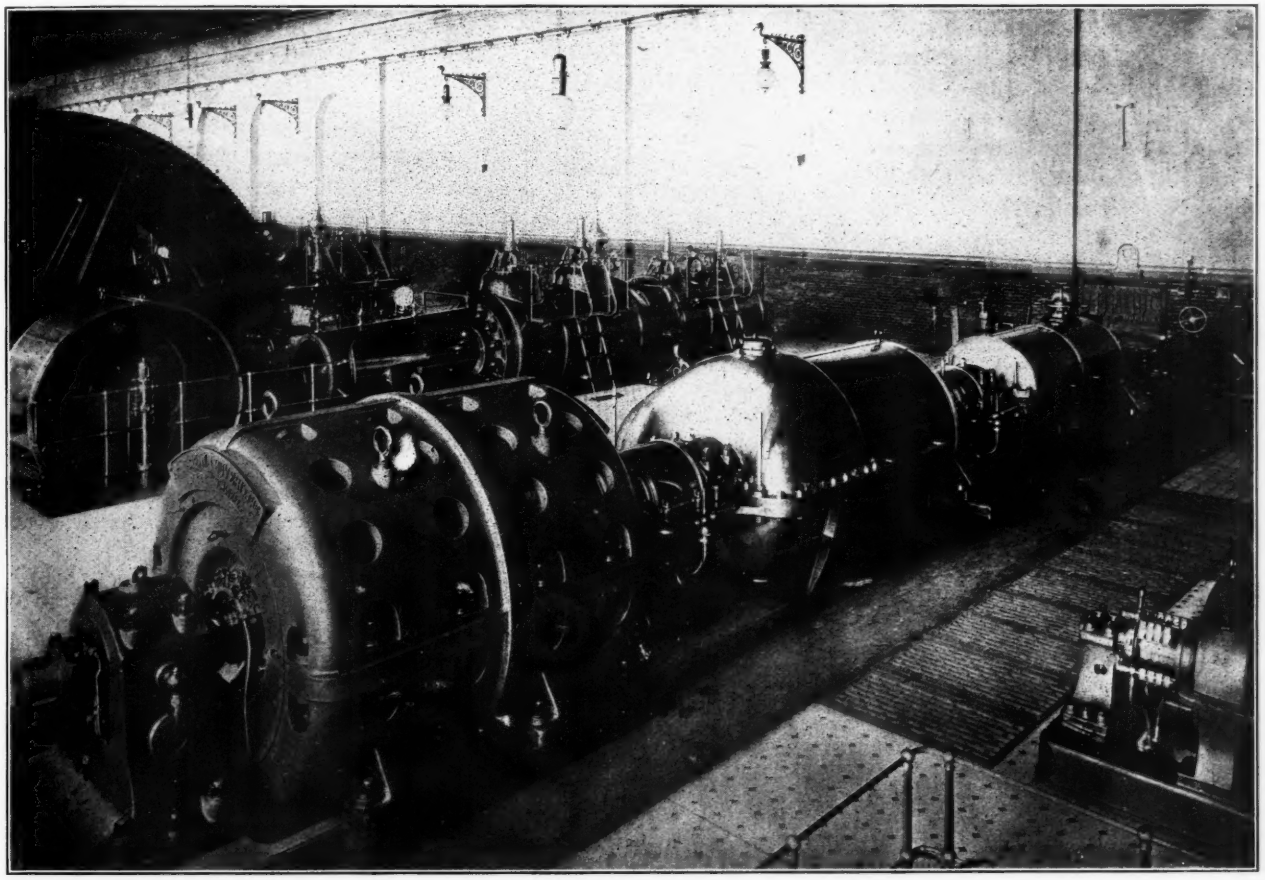


FIG. 1.—3,200-3,000-VOLT TURBO-ALTERNATOR AT THE FRANKFORT MUNICIPAL STATION.

As regards steam consumption in the present group, a few of the principal results which were obtained upon a series of tests made in the station at the time of installing the turbine are given in the accompanying table. The following table shows the general figures taken in the trials under different loads which varied from 2,000 to 3,000 kilowatts on the alternator. A water resistance was used for

the load, and this was kept constant during the tests.

TABLE 1.—STEAM CONSUMPTION OF TURBINE.

Steam pressure at the inlet in lbs. per sq. inch. . .	179.5	181.8	156
Vacuum, per cent.	93.2	91.8	90.6
Superheating, degrees C.....	298	295	312
Load on the alternator, kilowatts.....	1 945	2,518	2,995
Steam consumption per kilowatt-hour in pounds.....	15.85	15.6	14.75

In order to compare this performance with the steam consumption of the engines, take the example given above in regard to the 750-horse-power steam engines of the station. Here, as already noticed, the rate is 25.3 pounds per kilowatt-hour on normal load, or 26.2 pounds for the maximum load. For the steam turbine, as will be seen, the consumption is much less, seeing that for the normal load we have but 14.75 pounds per kilowatt-hour on the normal load and 14.3 pounds for the maximum load. For the steam turbine the steam consumption is less as the load rises, on the contrary, to what happens for the steam engine. In the Frankfort station the steam dynamo has been running continuously day and night, except for a short stop of one hour per week for overhauling and cleaning of the turbine and condenser.

Applications of Electricity.

The Cooperative Electrical Development Association, Cleveland, Ohio, has compiled a booklet entitled "Applications of Electricity." This gives a very complete list of the applications of electric current, indexed under various lines of business.

The objects of the Cooperative Electrical Development Association are:

First—The promotion of an increased and more extensive use of electricity by the public, for light, heat and power, as both an end in itself and a means to the increased demand for electrical apparatus and supplies, and the cooperative planning and execution of various means and methods effective to this end.

Second—The establishment of cooperative relations, both moral and financial, among the different electrical interests, from manufacturer to consumer, to the end that each may contribute in some measure toward bringing about the above results desired in common by all.

LIBERTY AND ORGANIZATION.[1]

BY F. A. PATTISON.

If any part of the infinite plan under which this world of ours is developing is comprehended by man it seems to be the preservation and betterment of the individual and the fact that organization means strength. Gathered as you are from all quarters of this broad country of ours, there is naturally some common motive which actuates you, and it is undoubtedly the aim and object that holds together all trade organizations as distinguished from technical societies. Perhaps, in view of this fact, it would not be amiss for us to study for a short time this question of associations from the point of view of an outsider or interested onlooker.

What, then, are the common interests that draw men together in an association which expresses to the world that they stand for all that is good in a given trade? Whenever several men or companies are bonded together for the promotion of common interests they immediately create certain relations with obligations and privileges which they are bound to regard and the treatment of which determines the standing of the trade, the association and the individual. In a trade like electrical contracting these obligations are:

1. Obligations to your association.
2. Obligations to labor.
3. Obligations to materials.
4. Obligations to your customers.

So bound together and interwoven are these several relations that it is impossible to be untrue to one without affecting some and nearly always all the others. As a rule, every one is ever ready to take advantage of and insist upon all the privileges, but few are equally alive to the obligations. It should never be forgotten that there can in all fairness never be a privilege without a corresponding and equally binding obligation.

I have designated as the first obligation that to the association. The precise and paramount objects of any single organization are naturally unknown to me, but through my acquaintance with your members in many localities throughout the country, and by your reputation, I believe one is justified in starting on the premise that your association stands for all that is best, most upright and honorable in the conduct of electrical contracting. Living under this banner it is indeed a great privilege to be a member of your organization, and each and every member is under equally great obligation not only to live up to that standard, but to see that every other member does so. This high grade of association can only be sullied in two ways, *viz.:* by the honest member who fails to live up to it because of undertaking work too large for his financial standing, or work he does not know how to perform; and by the dishonest member who deliberately does not do the best and right thing. An association should be only so large as it can be and contain only members of the first class, and should be so graded that the good name of the organization does not suffer from either of the above-mentioned weaknesses. We can not all do the same kind or the same size of job, and do ourselves justice, but we all can and should if we belong to the same association do the same grade of work; therefore, grade yourselves or those you deal with will grade you and you will have to accept the rating. This is one weakness of the labor organizations. Instead of grading they say we are all alike and must be paid alike. With graded and classified membership an association stands in such a position that any one may with perfect safety employ a member of that association and be sure of the grade of work for which the organization stands. It is self-evident that the character of an association is determined by an integration of the behavior of the individual members. There is, therefore, a binding obligation to each other and to the association in each and every act in carrying on the every-day transactions. The true test of these various and complicated relations in every move is this: "Is every one concerned getting a square deal?" If every one is able to answer this in the affirmative, there never will be any need of that weakest of all excuses that "Business is business." All are in business to make money, and an association is formed to further these ends; but when an association or its members follow this purpose without regard to the means employed, the result is sure to be disastrous. It is formed to assure the greatest good for all, not for the greatest number. Any member of an association who to further his own interests or for any other purpose does not give a fellow-member a square deal is a traitor to the association and not only injures the member and himself, but also the association, and this, too, whether any formal declaration covering the specific case exists in the constitution or by-laws. It is in accord with the unwritten law that should control the actions of any one having the title of a gentleman, and an asso-

[1] Abstract of an address delivered before the convention of the National Electric Contractors' Association, Cleveland, Ohio, July 18-20.

ciation should never be composed of any but gentlemen.

In this age there would be no need of a contractors' association if it were not for the fact that the contractors have to buy labor and materials. The most important and complex question before the American people to-day is the labor problem, and the contractors have been working for years to solve it. But there will never be any permanent solution of the problem until it is approached by both sides from the standpoint of justice, rather than that of advantage to one party or the other. Business is so based on money values or similar consideration that it will be impossible for two organizations to be on a fair basis in a business proposition until both are reliable and subject to the same forfeiture for non-performance. If an organization claims the power to make a bargain for its members it must make itself liable by bonds or other considerations, not only in order to give the organization it is making a compact with fair play, but also for the proper protection of the rights of its individual members. In this age it is necessary for both sides of any agreement to have a sufficient bond at stake to make them think before they act and to prevent being led astray by the hotheads.

One of the useful members of society is he who makes things, but from the contractor's point of view one of the most useless members of society is he who makes things and sells them and then won't stand behind them. This brings us to the contractors' relation to the material supply. There are but three essentials in this relation, *viz.*, price, grade and delivery. The question of price can be determined by the rules of barter until complications set in, and then it becomes necessary for the association to step in, and demand just treatment. It is a very unfortunate fact that there are manufactures of all grades of materials for any one given use. The instant a good device appears the market is flooded with cheap imitations or substitutes. This opens the field of gambling to the contractor. But it should not affect members of the same association, for in all fairness to his fellow-members every member should state in his bid, if not bidding on a specification, exactly what materials he proposes to use. Otherwise what protection has a member against the worst kind of cut-rate, cheap-grade work from his fellow-members as well as from the outsiders? What advantage is it to belong to an association if you know you can not have a square deal from the members? Any one is better off on the outside where he has to consider self-interest alone and catch the poor unbenighted customer with any bait he sees fit to use. Here is an opportunity for the association to be one in deed as well as in name.

Again, too often is a contract made between a supply association and a contractors' association, and the pernicious rebate system gives advantage to a selected few. Here again we fall far short of the ideal association. Any organization has to have its officers and committees to carry on its affairs, but the moment they become a ring it is time to clean house and consider the greatest good for all and not for the greatest number.

Probably no one subject has caused greater stretches of the imagination than promises of delivery. It would seem wise for associations to pay some attention to questions of grade of materials and time of delivery and see if its members can not be better protected in these two particulars rather than lay all the stress upon price. It may at first blush seem foolish, but it seems to me if a powerful association took proper care of its members there would be less black mud sold for rubber, less painted spaghetti for soft-rubber tubing, fewer rejected panel-boards and switchboards, less painted putty for porcelain, no meters or instruments that don't mete, fewer overheating dynamos, a smaller number of galloping motors, a minimum of steam-eating engines. In other words, in time perhaps, the material men would cater as strongly to good grade as they do now to price. It is a very difficult matter for a small contractor or even a large one to compel any of the large corporations to live up to delivery promises, but if he has a national association back of him he would be listened to and heeded much oftener. It is often a matter of financial loss and most always the estrangement of a customer to fail in performance on account of non-delivery. Therefore, permit me to offer as a suggestion that such matters be studied and acted upon by associations instead of individuals.

In all the industrial world the most important essential is the customer. You are in business to promote industrial progress and make money, and therefore the most important relation to the contractor is that to the source of income, namely, the customer. It seems to be the first impulse of this busy world to regard any one who suggests any attempt to try to realize the ideal as a dreamer or a charlatan, and yet I venture to assert that the relations existing between contractor and customers to-day is far from what it should be. We have tried the system of everybody for himself and the devil take the hindmost, and the results you all know if you read the papers and magazines and have a good honest talk with yourself. Can the trade associations do anything to help better the conditions? They most assuredly can and will, for if not of their own initiative they will be compelled to by the sentiment of the people.

The divines in their baccalaureate sermons to technical graduates are dwelling at length upon ethics in the engineering world, the professional societies are discussing professional ethics, corporations are investigating themselves, and throughout the industrial world better behavior is looked for, expected and insisted upon. The people are becoming politicians in the best sense of the word. All this tends to show that we are all beginning to realize that we have been following the wrong path. We are awaking to the fact that a real man must be a man at all times and under all circumstances; that dishonesty is dishonesty, no matter what high-sounding or conscience-appeasing names we may choose to give it; that one can not be a dishonest man and at the same time an honest tradesman, contractor or professional.

What then is the course for the organization to pursue to help toward the rule of fraternalism rather than individualism? This country has shown to the world many examples of contest for principle without regard for monetary gain, and thousands upon thousands of its citizens have shown themselves to be men in every sense of the word. Organizations should continue this spirit and stand for something besides money-making. Now do not make the false inference that we for one moment do not believe in money-making. It is a very necessary, honorable and noble calling. Any one and every one if they so desire should make all the money they can honestly, but beyond that the spirit of the world is changing, and instead of standing in open-mouthed wonder, admiration and praise, it is crying halt, where did you get it? We, the people, demand an explanation. First, then, an organization should stand for high-grade membership. No individual or company should be allowed to become a member until it has shown itself to be capable. This applies more forcibly to labor organizations, but is equally true of trade associations. No one should be admitted who is not perfectly honest in every detail, in all deal-

ings with fellow-contractors, material men, workmen and customers. Outside of all questions of ethics or morals, it absolutely pays to be honest.

Second, the spirit of cooperation should be predominant. Not only should this apply to your own trade but to others and also to the owner. More cooperation and fewer attempts to gain advantage would work wonders in the progress of carrying out contracts. There must be absolutely no unfair treatment of any one concerned either openly or under the guise of business custom or other puny excuse. Fair, open, man-to-man dealings is what will be insisted upon in the near future. The people want it or they would not applaud the late revelations of crooked dealings which are but the natural outcome of the business methods for years past.

Third, organizations should have graded membership. If they do not, time will bring about a large number of smaller organizations, each comprising a certain branch of each trade, and the arrival of cooperation and harmony will be again postponed. It is sufficiently difficult to have peace between the several trades, but with smaller subdivisions trouble will be too plentiful to have peace abide with us.

Fourth, establish and maintain a code of contracting ethics. Call it by any name you will, but have something in organization that corresponds to professional ethics. One man's honor should be just as high as another's, no matter what his calling. This system has had a universally good effect in all professions in spite of some awful lapses. The world will accept your trade on the plane upon which you place it, and therefore I would say place it on a high plane and not only maintain it but raise it just as much higher as possible.

Electrical Night at the Coliseum, Chicago.

On August 28 the Coliseum Company, Chicago, Ill., gave a special concert for the officers and friends of the Electrical Trades Exposition Company at the Coliseum. Among the guests were about 600 electrical men and their families. Ellery's Band, Channing Ellery, manager, prepared a special programme for the occasion, and the audience appreciated to a high degree the rendition by this band and the work of its well-known leader, Francesco Ferullo.

RECENT ADVANCES IN OUR KNOWLEDGE OF RADIATION PHENOMENA AND THEIR BEARING ON RADIATION PYROMETRY.[1]

BY J. B. HENDERSON.

In a previous paper[2] I drew the attention of engineers and physicists to the recent advances in the theory of radiation which have been made during the last decade, principally by the Berlin school of physicists—on the theoretical side by Boltzman, Planck and Wien, and on the experimental side by Lummer, Pringsheim, Rubens, Paschen and Wanner.

The laws of radiation which have been developed theoretically and confirmed experimentally are four in number, and apply to the radiation from any ideal black body. They are

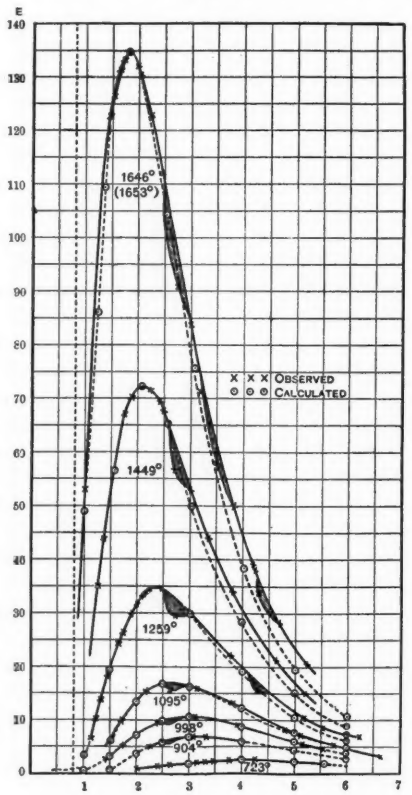


FIG 1.—COMPARATIVE DATA.

1. $\int_0^\infty E_\lambda \, d\lambda = \sigma T^4$ (σ being a constant)—Stefan-Boltzman law.
2. $\lambda_m T$ = constant } Wien's law of
3. $E_m T^{-5}$ = constant } displacement.
4. $E_\lambda = \frac{a \lambda^{-5}}{\epsilon^{\frac{b}{\lambda T}} - 1}$, ($a$ and b being constants). Planck's law of the partition of energy in the spectrum.

λ_m is the wave-length of maximum radiant energy in the spectrum, E_m the value of the maximum radiant energy, and T the absolute temperature. The expression proposed by Wien for the partition of energy in the spectrum differs from Planck's only in omitting the figure unity in the denominator, and may be interchanged with Planck's if λT is less than 3,000.

The comparison between Wien's expression and Lummer and Pringsheim's experiments is shown in Fig. 1. It will be noticed that there is considerable deviation from the experimental results at long wave-lengths, but if Planck's expression is used these deviations disappear, except such as are within the limits of experimental error.

The above laws are developed theoretically from Maxwell's electromagnetic theory and the laws of thermodynamics, as was pointed out in the former paper.

All accurate radiation thermometry is founded on these four laws; hence, wherever accuracy in radiation thermometry is required it is very important to remember the limitations of the laws—namely, that they apply only to the radiation from an ideal black body. Kirchhoff showed that the radiation inside an enclosure whose walls are at uniform temperature is the same as would be emitted by an ideal black body at the same temperature; and by using the radiation from cavities whose walls were heated electrically to uniform temperatures, the theoretical laws have been experimentally proved.

If, then, we wish to obtain accurately the temperature of any material in a furnace by means of the radiation which it emits, we must take the radiation from a cavity whose walls are at the required temperature. If the material is in liquid or pulverous form, a tube closed at one end serves the purpose if the closed end is inserted in the material and the radiation taken from the closed end. If the material is in ingot form and there is no serviceable hole in it we can use an auxiliary piece of similar material provided with a hole and placed against the ingot, so as to have practically the same temperature as the ingot. The hole or cavity may bottom against the ingot or in the auxiliary piece of material.

To use a radiation pyrometer in the tempering of armor plate on a cooling curve, it would be necessary to lay another plate with holes in it on the one to be tempered, then heat the two together in the furnace and after withdrawing them from the furnace to focus the thermometer on the bottom of one of the holes.

[1] Paper read before the British Association (Section A) at York, Wednesday, August 8.
[2] *Electrician* (London, vol. li, p. 773, August 28, 1903.

When the required temperature is indicated, the upper plate could be removed and the lower one quenched, the upper one being returned to the furnace with the next plate.

In every case where the temperature is read while in the furnace, it is necessary to shield the radiation from luminous flames after leaving the cavity. This may be done by means of tubes, and the temperature of the walls of these tubes will not affect the result, provided an image

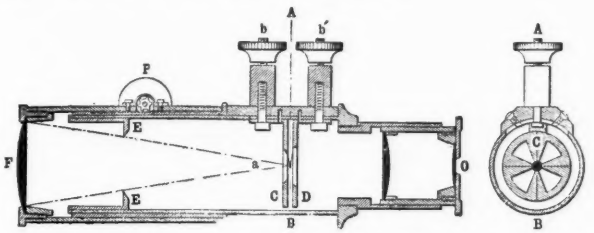


FIG. 2.—FERY'S RADIATION PYROMETER.

of the cavity is formed on the sensitive surface of the thermometer.

The principles on which the present radiation pyrometers are founded are the first and fourth laws. Those founded on the fourth law we may distinguish from the others by the term optical thermometers because only the luminous portion of the spectrum is used. Law ii does not lend itself well to temperature measurement, because the maximum radiation is not well marked, especially at low temperatures; but it has been used in the laboratory to fix limits for the temperature of our luminants, of the sun and of some fixed stars. Law iii, which measures the maximum energy in the spectrum, promises better than Law ii, but it has little

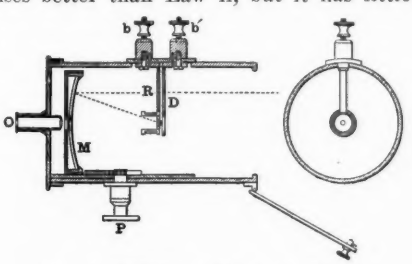


FIG. 3—SECTIONAL VIEW OF FERY'S RADIATION PYROMETER.

advantage over Law i, and the instrument would be much more complicated.

Pyrometers based on Law i have a black receiving surface for absorbing the radiation from the radiating body. This surface may be one of the junctions of a thermo-couple, or the wires of a bolometer or one arm of a radiometer balance, but as we are more concerned with instruments used in the industries than with those used in the laboratory, the following descriptions will be confined to the former.

Figs. 2 and 3 show two types of Féry pyrometers. In Fig. 2 the image of the radiant is formed on the receiving surface by means of a fluorite lens, although in some technical forms a particular kind of glass having low absorptive power in the infra red is used for the lens. The temperature of the receiving surface is measured by a thermo-couple and portable galvanometer. This pyrometer lacks sensitiveness at temperatures below 900 degrees centigrade, and to increase the sensitiveness Féry replaces the lens by a concave mirror, making a reflecting telescope, as shown in Fig. 3. This form can measure down to 600 degrees centigrade. The eye-piece in both instruments is for sighting purposes, as an image of the radiant must be formed on the small receiving surface of the junction. So long as this image is larger than the receiving surface the reading of the pyrometer is independent of the distance from the radiant, because both the total

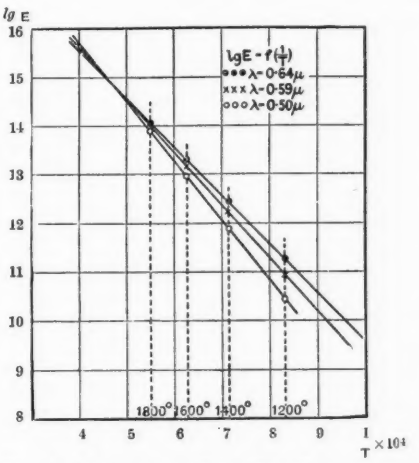


FIG 4—COMPARATIVE DATA FOR THEORETICAL AND EXPERIMENTAL RESULTS

radiation received by the lens or mirror and the area of the image vary inversely as the square of the distance from the radiant, hence the intensity of the image is constant.

In a perfect pyrometer of this kind the receiving surface should be ideally black, and in some researches Lummer and Pringsheim have used cavities as receiving surfaces. The error introduced in a practical instrument due to this defect is, however, not of great significance. The accuracy of the Féry instrument is within one per cent between 800 degrees centigrade and 1,600 degrees centigrade with ideal black radiation.

Law iv gives us the equation connecting the radiant energy with temperature along an isochromatic curve. This may be written.

$$\log E = c + \frac{d}{T}$$ where c and d are constants.

If, then, we confine our attention to one luminous wave-length, say the red line transmitted by red copper oxide glass, and plot log E as a function of 1/T, we get a straight line. Fig. 4 shows a comparison between theory and experiment for several

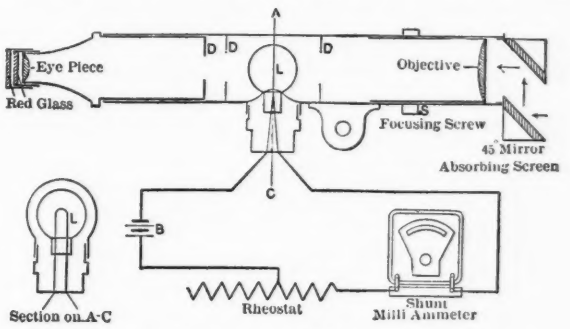


FIG. 5.—HOLBORN AND KURLBAUM'S OPTICAL PYROMETER.

isochromes. This is the scientific foundation of all optical pyrometers. It may be easier to calibrate them empirically, but it is possible to calibrate them by means of this equation.

Optical thermometers are simply spectro-photometers of simple form. Among the laboratory forms are le Chatelier, the Féry absorption type, the Wanner and the Lummer instruments, for a description of which the reader should consult the original memoirs or "High-Temperature Measurements," by le Chatelier, Boudouard and Burgess (Wiley & Sons).

The most practical form of optical pyrometer, however, is that due to Holborn and Kurlbaum, which is shown in Fig. 5. An image of the radiant is formed in the focal plane of a telescope, and is there superposed on the filament of a small electric lamp placed in the focal plane. The current in the filament is then varied until the filament, as viewed through the eye-piece of the telescope, can not be distinguished from the image of the radiant. The current in the filament then forms a measure of the temperature. To standardize the instrument each lamp is first of all aged and then calibrated to get the connection between the current and the temperature of the filament. In measuring very high temperatures the radiation is weakened by dark glasses or by successive reflection, the glasses or reflecting surfaces being also standardized. Red glass is used in front of the eye-piece.

The following table given by Burgess shows the accuracy of the instrument at two points on the scale:

Temperature from H. & K. Pyrometer.	Temperature from Thermo-Couple.	Temperature from H. & K. Pyrometer.	Temperature from Thermo-Couple.
1,347	1,347	632	634
1,351	1,347	634	638
1,343	1,343	633	633
1,334	1,342	633	632
1,342	1,342	...	...

Electrical Equipment of a Lumber Mill.

An Interesting Use of Belted Motors in the Eggers & Graham Lumber Company's Mill at Uniontown, Pa.

THE conditions encountered in lumber mills present, in many respects, problems in power transmission not found in other industries. The material employed and the wastes are very inflammable, and the size of the work handled and the severe power demands for starting and operating wood-working machinery of necessity require a motive power that is not only immune from fire risk, but which will withstand heavy fluctuations in load and operate the various machines with as little obstruction to the handling of the materials as possible.

In the old method of driving by means of overhead shafts and belts these conditions were but imperfectly fulfilled, and, moreover, on account of the losses in the shafting and belts the transmission system was inefficient. Numerous countershafts were required, not only occupying much valuable room, but adding to the lost power. In such installations the frictional losses were always great, the belts required constant attention, were expensive and slipped under the severe fluctuations of load necessarily thrown upon them; and, more than all, they were objectionable because of the danger to life and limb which is inherent in this type of drive and on account of the large floor space occupied. This latter inconvenience brings about an additional risk, since the sawdust and chippings necessarily accumulate in places from which they are removed with difficulty, grease and dirt are mixed with them, and a very inflammable material results, bringing an added fire risk.

These conditions have led to the demand for a method of driving which would eliminate, in the main, many of the objectionable features involved in the old system. Naturally the electric motor was the one selected. When it is adopted the mill may be divided into sections of convenient size, and each floor or each group of machines, or each individual machine supplied with its own motor, thus producing a flexibility which is of especial value when the work is light or when the mill must run overtime. Even though the belted type of motor be adopted, the overhead countershafts and belts are, to a large degree, eliminated, thus removing the objectionable and dangerous features attending their use. These considerations led the Eggers & Graham Lumber Company, of Uniontown, Pa., to adopt the electric drive in its mills, and the accompanying illustrations show, in a striking way, what may be done by the substitution of the electric motor for the old system.

The electrical system adopted is a two-phase, alternating-current system supplying induction motors operating at sixty cycles, 200 volts. Current for the motors is supplied by the West Penn Railways Company, and each machine throughout the mill is driven by its own motor. These are all of the Westinghouse CCL type, with the exception of the motor driving a mortising machine, which is of the C type.

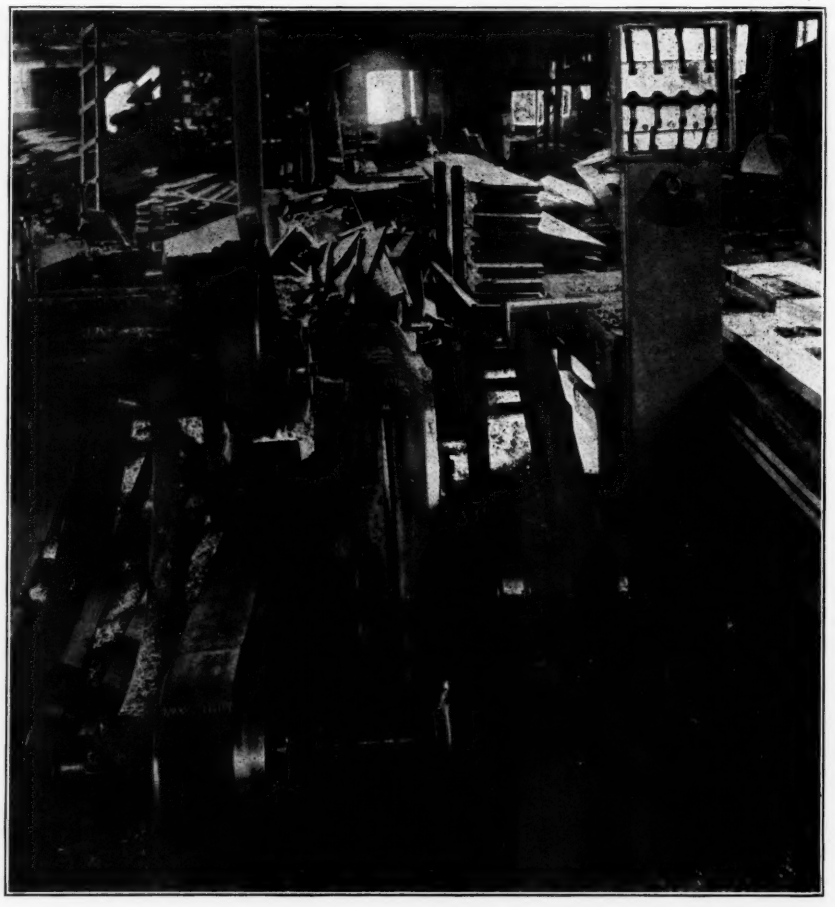


FIG. 1.—THREE-HORSE-POWER INDUCTION MOTOR DRIVING A RIP SAW.

Fig. 2 shows a fifteen-horse-power induction motor driving a moulding machine. From the arrangement it is evident that but little space is available, yet the motor and its belt are easily accessible. To the left of this machine is shown a rip saw. Another view of this saw is given in Fig. 1, where the motor (rated at three horse-power) may be seen. In Fig. 2, in the background, may be seen two small motors. These are rated at one-half horse-power each. One drives an emery grinder hidden behind the moulding machine mentioned above, and the other drives a grindstone, which may be seen. The controlling switches for these motors are placed conveniently on the side wall.

Fig. 3 is a view of a fifteen-horse-power induction motor driving a planer. From the amount of sawdust or chips shown in this view the pressure under which the work is being carried through the mill is indicated. Fig. 4 shows the type C induction motor referred to above, driving a two-horse tenoning machine.

In addition to the motors shown there are a five-horse-power motor driving a ten-inch cross-cut saw, a five-horse-power motor driving a pony planer, one rated at four horse-power driving a panel raiser, and one of one horse-power driving a shaper. A hand-feed planer is driven by a three-horse-power motor, a hand saw by

another of the same rating, and a second rip saw is driven also by a three-horse-power motor.

tration of the excellent fire risk obtained when motors of this type having no commutators or other parts at which flashing

it necessary to furnish the motors with covers, which, of course, interfere very considerably with ventilation. The in-

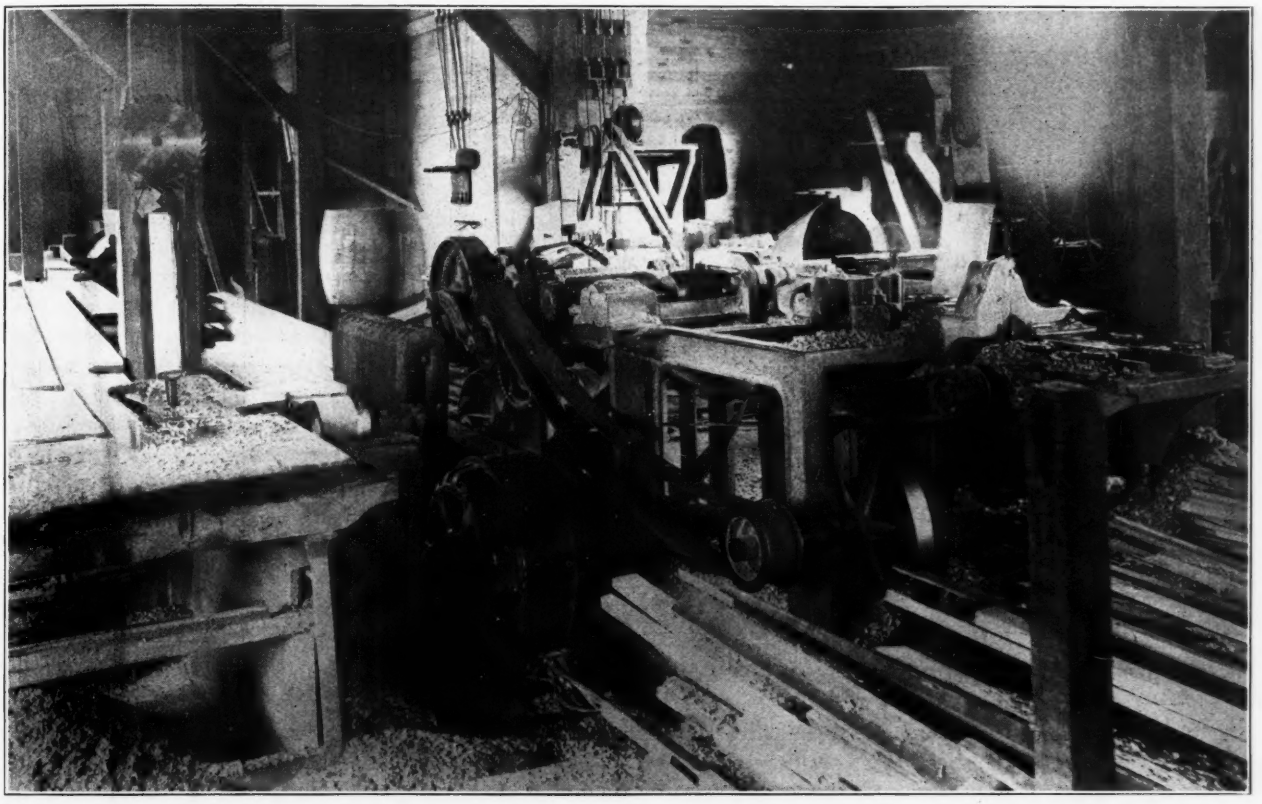


FIG. 2.—FIFTEEN-HORSE-POWER INDUCTION MOTOR DRIVING A MOULDING MACHINE.

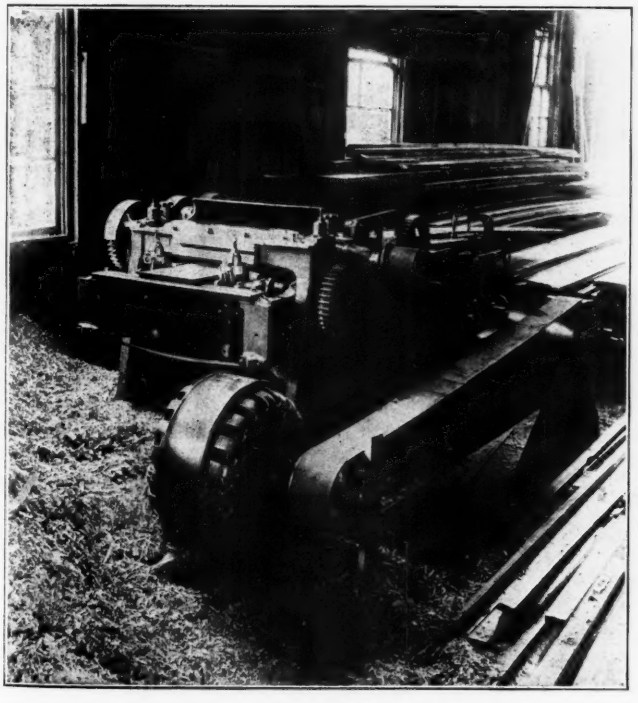


FIG. 3.—FIFTEEN-HORSE-POWER INDUCTION MOTOR DRIVING A PLANER.

FIG. 4.—TWO-HORSE-POWER INDUCTION MOTOR DRIVING A TENONING MACHINE.

The illustrations give a striking idea of the severe conditions encountered in this type of service and furnish a forcible illus-

may occur are adopted. In certain positions in the mill the accumulation of refuse is so rapid and so great as to make

stallation in this mill is operating day and night, to the entire satisfaction of the owner.

An Electrical Spectacle at Connellsville, Pa.

The accompanying illustrations show the electrically illuminated and decorated coal and coke arch recently installed at Connellsville, Pa., by the H. C. Frick Coke Company, commemorating the one-hundredth anniversary of the town. Connellsville is the centre of the coke-producing territory of the state of Pennsylvania, and its output is considered among the best in the world.

Thirty tons of coal and seven tons of coke were required to build this arch. The lighting required about 600 sixteen-candle-power lamps. For the other lighting decorations nearly 6,000 lamps were used; current being supplied by the West Penn Electric Company, of Connellsville, which controls the trolley and lighting interests, covering about 100 miles of territory.

Electrical Illumination, Hundredth Anniversary of the Town of Connellsville, Pa.

Coal and Coke Arch, Hundredth Anniversary of the Town of Connellsville, Pa.

We are indebted to E. T. Penrose, superintendent of the West Penn Electric Company, for the illustrations and facts.

Niagara Falls Meeting of Electrical Jobbers.

Nearly 300 members and guests attended the meeting of the electrical jobbers held at Niagara Falls, N. Y., September 11, 12, 13 and 14. Two sessions were held each day, in which trade matters and the relations of its members to manufacturers and consumers were discussed.

The meeting was largely given over to entertainment and sightseeing. About fifty ladies were present. The entertainment committee, headed by W. E. Robertson, of Buffalo, gave a smoker and vaudeville performance at the Cataract Hotel on Tuesday evening, and following this a rejuvenation was held of the Sons of Jove and seventy-one new members were taken into the order. H. B. Kirkland was master of ceremonies for this rejuvenation. C. B. Roulet, Mercury of the order, came from Dallas, Tex., to be present at the rejuvenation.

On Tuesday a tug of war was held on the lawn of the Cataract, which created considerable amusement, and in the evening an informal dance was held.

On Thursday a baseball game was the feature, and in the evening a banquet was given at the International for jobbers and manufacturers.

The following prominent representatives of the electrical manufacturers were among those present:

C. E. Corregan, E. J. Kulas, J. C. Fish, A. D. Page, Frank Harrington, Bailey Whipple, Walter Cary, H. B. Kirkland, R. B. Corey, Charles Munder, John W. Brooks, J. E. Way, H. B. Bliven, Albert S. De Veau, J. B. Estabrooks, Ralph A. Schoenberg, Harry Adams, J. B. Olson, A. C. Garrison, Charles I. Hills, Charles Flack, N. C. Cotabish, V. C. Gilpin, J. Wilson, A. E. Carrier, E. J. Wilson, M. H. Moffett, F. D. Masterson, Harry P. Moore, T. C. Walsh, George E. Seaving, H. O. Phillips, G. F. Brunt, A. H. Pease, F. B. Smith, H. A. Waterman, E. G. Bernard, Thos. G. Grier, William Crockett, S. H. M. Agens, Francis Raymond, H. T. Paiste, F. Overbaugh, James Wolff, W. W. Merrill, E. A. Downes, W. F. Sisson, W. C. Bryant, E. B. Dodge, J. Robert Crouse, C. O. Baker, A. B. Palmer, W. K. Patton and A. W. Spear.

The Cincinnati Fall Festival.

The Cincinnati Fall Festival, which opened on August 28 and will run until September 22, under the direction of the Cincinnati Fall Festival Association Company, has this year arranged an electrical exhibit, the main object of which is to familiarize the general public with the many ways in which electricity and electrical apparatus and appliances may be utilized in every-day life.

The Cincinnati Gas and Electrical Appliance Company, an offshoot of the Cincinnati Gas and Electric Company, now the Union Gas and Electric company, has a handsome booth, with E. A. Sarran and George A. Conway in charge, where are shown chafing dishes, curling irons, flat-irons, sewing-machine motors, batter-cake griddles, coffee percolators, heating pads, hot-water heaters of all descriptions, etc. Mr. Sarran reports many inquiries from callers respecting the cooking and heating devices, and believes the company is making progress in its efforts to introduce these appliances. At the same booth the Federal Electric Sign System, of Cincinnati, shows electric signs.

The Warner Elevator Manufacturing Company, a well-known Cincinnati concern, established before the first half of the last century had ended, has within a few years added electric elevators, and within the past year has put out its patent push-button electric-control elevators. The one shown at the festival will be shipped to New York later for installation, the building there not being ready to receive it. It is a duplicate of the one that will be placed in the Jewish Hospital, Cincinnati, shortly. Upon pushing the button the car comes automatically to the floor; upon the person entering, the elevator will not move until door is closed; the party inside then pushes an indicator indicating the floor at which he wishes to alight, and the elevator runs to that floor and stops automatically. The occupant then opens the door to that floor, and nobody can take the elevator away until the door is again closed. This exhibit is in charge of John Hitzler and C. H. M. Atkins, president of the company.

The Chicago Pneumatic Tool Company shows its enterprise in setting up an exhibit which none of its Cincinnati competitors have emulated. Messrs. Walker, Aplin and Coates are in charge. Special electrical tools and accessories, such as portable grinder and buffers, portable pressure blowers, drilling stands, and air-cooled Duntley electric drills, single-motor, two-motor and three-motor, with armored cable, are shown. The magnetic "old-man" will withstand an upward stress of 1,200 pounds, and is superior in many points to the mechanical "old-man" heretofore used.

The Bullock apparatus, shown by the Allis-Chalmers Company, is on display, and comprises several induction motor-generator sets of twenty-five kilowatts, with starters complete, and other electrical apparatus.

The Lodge & Shipley Machine Tool Company, of Cincinnati, includes in its exhibit a twenty-four inch patent head lathe, motor-driven. The system permits the use of any motor having a speed variation of not more than two to one. The motor is mounted on an extended cabinet leg at the head of the lathe, and is connected to the lathe spindle through gearing at the back of the headstock.

The J. A. Fay & Egan Company, in connection with its wood-working machinery, shows Westinghouse electric motors.

The Cincinnati & Suburban Bell Telephone Company has a handsome booth, F. L. Van Arsdale in charge. In this booth is located the Fall Festival exchange. The exchange has connection with all booths so that exhibitors may have constant communication with their down-town offices. This booth was designed by J. E. Peavey, superintendent of exchanges. An interesting feature to the general public is the radiophone, in charge of George Johnson, who uses the same radiophone apparatus which was shown at the St. Louis World's Fair. It transmits in this instance sound by light-waves a distance of 150 feet. In the balcony is located a powerful searchlight, the rays from which are received by a concave reflector in the booth. A phonograph plays into the arc light, whose rays thence transmitted to the concave reflector are focused upon selenium, the light-waves resolved into electrical energy, and this again converted into sound-waves in the ear receivers.

The Post-Glover Electrical Company, of Cincinnati, shows a great variety of fixtures and apparatus, several show cases being filled with a miscellaneous assortment of appliances. The handsome bronze electroliers, female figures one-third life-size, imported from Austria, attracted attention. This company also had some beautiful designs in art glass domes of its own make, and portable lamps. The exhibit is in charge of H. S. Kinnicutt, Frank Kindleberger and William Schlewinsky.

J. W. Weatherington, an enterprising photographer from Louisville, is picking up the dimes making very clever pictures on postal cards. Curious to learn how these effects were produced, the representative of the ELECTRICAL REVIEW found Mr. Weatherington using the Cooper Hewitt mercury vapor lamp, which he declares is unequal for his work, costing one-half as much as the arc and giving three times the actinic power; it also has great diffusive power.

Wandering further, in the Berninghaus barbers' supplies exhibit, there was shown the James Barker (Philadelphia) motor-driven vibrator for use in massage.

The special committee on electrical exhibits is as follows: Frank D. Lawrence, J. C. Hobart, Luke Lilley and J. A. Brett.

D. A. B.

Osram Lamps.

The following particulars have appeared in a number of foreign journals regarding the Osram lamp, which is being introduced by the Deutsche Gasglühlicht Aktien Gesellschaft. The lamps are rated at from thirty-two to fifty candles, and are put out for pressures from 100 to 130 volts. Their efficiency is said to be one watt per candle, and a life of 1,000 hours is claimed for them when running at the correct voltage. Tests made by the Physikalische Technische Reichsanstalt with certain of these lamps rated at thirty-two candle-power showed a decrease of about three per cent in the light after burning for 1,000 hours. With the higher-candle-power lamps a still smaller falling off was found. The lamps are said to give the same light whether used on direct or alternating-current circuits. During the Reichsanstalt life tests the circuit upon which they were running was operated under ordinary commercial conditions, and the voltage varied from two to three per cent. Little or no appreciable variation in the brilliancy of the lamps is noticeable under these variations. The accompanying diagrams have been drawn from the Reichsanstalt tests.

Colorado Electric Light, Power and Railway Association.

The convention of the Colorado Electric Light, Power and Railway Association will be held at Denver, Col., September 18, 19 and 20. A number of features have been arranged for, and the following papers have been announced: "Voltage Regulation," Leonard Wilson; "The Use of Polyphase Motors in Outlying Districts," W. A. Carter; "Profitable Commercial Cooperation," J. Robert Crouse; "The Lighting of Small Stores," J. R. Cravath; "Water-Type Lightning Arresters," A. M. Ballou; "Transformer Testing and Line Records for Transformers," E. P. Dillon; "Steam Turbines," C. C. Chappelle.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

A Self-Registering Electric Target.

A self-registering electric target designed by Colonel George A. Peters, of Toronto, Ontario, was exhibited at the Bisely rifle ranges, during recent target practice at Bisely, England. The particular apparatus shown there was to mark a four-foot target used in competition at 200 yards. The target consists of a target plate of solid one-half-inch steel. This is carried on four hinged brackets supported by a frame bolted to a foundation platform of heavy timber. The front of the main frame carries a milled steel plate one-half inch in thickness, forming a carrier for the recording hammers, which vary in number from sixty-one, in a target four feet in diameter, to 173 for a six-foot target employed for greater ranges. This plate is pierced by a series of oblong holes, through which the ends of the hammers project. The hammers are supported on pins, and, due to their weight, rest against the target plate. When thrown backward they make contact with brass plates, each thus closing a circuit through a wire, which drops a shutter on the announcing board. The distance between the hammer or supporting plate and the target plate can be varied to correspond to different service charges or different ranges. It is made so that a hammer will be thrown whenever a bullet strikes within a three-inch circle of the point of contact of the hammer with the target. There is one electrical circuit for each hammer and annunciator, and they are put up as an ordinary telephone cable. When a bullet strikes the target plate, if directly over a hammer, it throws this up and completes the circuit. If midway between two hammers, it will throw both, thus indicating the position struck; or it may throw three or more. In any event, the number thrown will, by means of the corresponding drops at the indicating board, give an accurate idea of the point struck.—*Abstracted from Engineering (London), August* 17.

Construction of Squirrel-Cage Armatures.

The types of construction of squirrel-cage armatures employed by the various large electrical manufacturing companies of the world are described here by A. G. Ellis. A number of these are very familiar. The use of the cast-iron spider in the large sizes is universal. In the smaller sizes the iron stampings are slipped directly on the shaft. The greatest variation in construction is in the method of making end connections. One company uses a solid ring drilled to fit the rotor conductors, which are inserted in the holes and then riveted up on the outside and turned smooth. Another uses a flattened ring which is slipped into slots milled in the ends of the conductors. Both of these give strong structures, and the latter a good cooling surface. The Allmana Svenska Elektriska Aktiebolaget, of Sweden, uses a peculiar construction. The ends of the rotor conductors are carried well out and then connected together by weaving a small copper wire around them. This wire is carried from conductor to conductor and is given one turn around each. The last few turns are then sweated to the conductors. This gives a strong construction with large cooling area. It has the advantage that, if desired, some of the outer turns may be taken off and thus the resistance of the connection be increased. The Alioth Company, of Switzerland, employs a ring having two series of projecting lugs upon it, leaving radial spaces between. The conductors are bent down into these spaces, and the lugs are bent alternately right and left over them. A construction used some time ago by the Svenska company consisted of a small ring in which radial slots were milled. The ends of the conductors were left long and bent down and fitted into these slots. The construction usually adopted in this country, which is a flat ring to which the conductors are bolted, is also widely employed in Europe.—*Abstracted from the Mechanical Engineer (London), August* 18.

Electrical Plant of the King Edward Bridge, Newcastle-on-Tyne, England.

On July 10 the new bridge known as the King Edward Bridge, on the North-eastern Railway at Newcastle-on-Tyne, England, was opened. On interesting feature in the construction of this bridge was the employment of electrical power throughout. Electrical derricks, an electrical conveyer, and electric power for driving the air-compressors were all used. The bridge consists of four spans and the total amount of steel work is 5,872 tons. A generating station was built and equipped with two direct-connected generators delivering each 750 amperes at 440 volts, and three smaller sets for supplying lights. Steam was supplied from locomotive boilers. The distributing system is divided into two parts, one for the caisson work, the other for the outside apparatus. Each caisson was provided with three shafts and was served by a five-ton electric derrick. The air-lock doors were heavy, and, for convenience, were operated by small electric motors. Compressed air was supplied by three compressors, each having cylinders fifteen inches in diameter and thirty-six inches stroke, running at ninety revolutions per minute. Each of these compressors was driven through gears by means of a 125-horse-power shunt motor. A cableway was erected across the river for delivering material at the piers. The span was 1,520 feet, and the carriage was served by a 100-horse-power motor. The cableway was capable of handling loads of ten tons, and, altogether, carried 40,000 tons of material. For constructing the spans a fifteen-ton gantry crane was used. This crane was fitted with shunt motors operated on the regenerative system. In addition to the machinery mentioned, the pumps, concrete mixers, mortar mills, saws and other tools were all electrically driven.—*Abstracted from the Electrical Review (London), August* 17.

The Limitations of the Ballistic Method for Magnetic Induction.

During the investigations into the magnetic properties of pure electrolytic iron which are being carried out by Professor C. F. Burgess, of the University of Wisconsin, it was found that great care is necessary in employing the ballistic method, and it became necessary to examine this method for sources of error and to see if it might not be improved. The chief error seemed to be due to magnetic viscosity, and such a source of trouble has been noted by various other writers on the magnetic properties of iron. It was found, however, that while this trouble

did exist, it was not alone responsible for the errors which crept in—errors which in some cases amounted to nearly fifty per cent. A convenient way of applying the ballistic method by the step-to-step process consists in arranging the apparatus with fixed constants and varying the current through the magnetizing coils by varying the applied potential. It was found that this method introduced an error, due to the time constant of the magnetizing circuit, and better results are obtained if a constant voltage be employed and the current be varied by varying the resistance in this circuit. In this way, when the currents are low, the resistance is high and the time constant small. In the step-by-step method errors are cumulative, and to get around this difficulty the process was changed somewhat in the following way: The magnetizing circuit was arranged so that, by closing one switch, a current would be sent through the magnetizing coil sufficient to carry the iron up to full saturation. Then, by closing a second switch and opening the first, the current was suddenly decreased from the former value to that at which a reading was desired. This method is more laborious than the other, but it gives values for the induction several per cent higher than the other, and a hysteresis area about eighteen per cent larger. The effect of the galvanometer period was also investigated, and it was found that with a period of five and one-half seconds the viscosity of the iron caused the reading for the induction to be considerably lower than when the period was fifteen seconds.—*Abstracted from the Physical Review (Lancaster), August.*

Electricity Applied to Rolling Mills.

In concluding a long communication on the application of electric power to rolling mills, M. Creplet considers first the amount of work necessary to be done in rolling ingots out into different shapes, and then examines certain methods of applying motors for this difficult service. In one of these a so-called power equalizer is employed. This consists of a booster exciter, the armature of which is connected in shunt with the series fields of the main driving motor (this motor being a compound machine), while the field-winding of the booster is connected across the main source of supply. The object of this machine is to enable the series field of the main motor to be varied either at the will of the operator or automatically, so that the speed variation of the main motor may be greater than that which would occur normally. For example, running as a cumulative compound machine, the speed of the main motor varies from 320 to 275 revolutions, with a variation in the armature current of from 200 to 800 amperes. If, however, the armature current were increased to 1,000 amperes, the speed would fall to 232 turns. By means of the booster the additional 200 amperes required through the compound winding to reduce the speed to the lower figure may be obtained. This arrangement then enables the motor to operate as a compound machine at speeds lower than it would develop normally. This feature is important, since the amount of work required in rolling different sections varies considerably. The regulator is mounted on the motor shaft, and a commutating switch is provided, enabling it to increase or decrease the current flowing through the series field. A table is given, showing the power required to roll various sections, the dimensions of which are noted. In all cases the total power required is considerably greater than that actually expended on the section. To roll a simple round bar weighing about thirty pounds to the yard requires twenty-seven and one-half kilowatt-hours per ton actual energy, 4.5 kilowatt-hours of which are useful. To roll a sheet weighing about two pounds to the yard requires an expenditure of 125 kilowatt-hours actual energy per ton, 62.5 of which are useful. The table indicates that the efficiency varies, according to the sections and to the method of handling them, from thirty-three to sixty-five per cent.—*Translated and abstracted from the Bulletin of the Association des Ingénieurs Electriciens (Liege), August 1.*

Electrical Machinery for Mines.

The use of electrical methods and apparatus in mining work has been increasing notably during the last few years. The advantages of this system are well recognized, but in its use, particularly in fiery mines, certain safeguards must be taken against fire and explosion. This phase of electrical machinery in mines is dwelt upon in this article by George Farmer. The author frankly admits the economy of the system as compared with other methods of transmitting and applying power, but contends that there is danger accompanying the use of the electric motor in mines where fire damp exists. He considers that the use of electric power transmission should be attended with the strictest care and that foresight should be exercised before putting in an electric plant. The prevention of ignition of mine gases from electrical machinery has been made the subject of exhaustive experimental investigations in Great Britain and Germany. The latter country took up the matter as long ago as 1885, and five years later a series of investigations was made by the French government. In Great Britain galleries were constructed above ground and fitted with mining apparatus. These were then filled with mixtures of explosive gases in order that the appliances should be subjected to the worst dangers apt to be found in mines. The dangers from electrical machinery underground lie principally in the possibility of sparking and consequent ignition of explosive mixtures. The most common remedy for fiery mines is a free circulation of air, but this can not always be guaranteed. It is therefore necessary to take precautions at the motor to prevent ignition. Gauze coverings of the commutator, while in most cases effective, can not be relied upon if the surrounding air provides a continuous explosive mixture at the commutator; nor can completely enclosed motors be depended upon. The following suggestions are made for securing the greatest degree of safety when installing electrical machinery in mines: All motors should be placed on a good solid foundation, so as to reduce vibration to a minimum, and thus avoid a frequent cause of sparking. For coal-cutting machinery the tracks should be laid carefully and solidly. It is very important to keep the motors scrupulously clean, free from dust and superfluous oil, and it is an excellent plan to make ample allowance all through the plant. Avoid cheap apparatus and make the machine suit the conditions of the mine, at the same time making the conditions of the mine as easy and safe as possible for the machine.—*Abstracted from Cassier's Magazine (New York), September.*

Detroit River Tunnel Contract Awarded.

The contract for the tunnel under the Detroit river, to be used by the Michigan Central Railroad, has been awarded to Butler Brothers Hoff Company, New York city. Several alternative plans were submitted by the railroad company, that selected by the contractor being the one designated as design A, though this has been modified somewhat. In this design the previous material underlying the river is to be replaced by an imperfectly watertight material of concrete placed under water, through which, without the use of shields, the tunnel proper may be constructed. The date set for the completion of the tunnel is June 1, 1909.

Methods of Getting New Business

A DEPARTMENT DEVOTED to the COMMERCIAL DEVELOPMENT of CENTRAL STATIONS

Managers are Invited to Contribute Suggestions for Methods of Increasing the Demand for Electric Service

NEW BUSINESS: HOW TO GET IT AND HOW TO KEEP IT, AS APPLIED TO A LARGE CITY.[1]

BY FRANK M. TAIT, DAYTON, OHIO.

Time was when the average central station man was bending every energy to secure the lowest possible generation and distribution costs of his current and the greater problem of securing a larger volume of desirable business was not the leading question it has become the last few years.

To-day the central station man is asking how he may improve the power factor of his plant, and what are the best means of procuring the desirable new business, and when it has been obtained how he may best retain it and encourage the further use of electricity after it has been connected to the system.

These questions are ones that must be very carefully considered, and a plan of action to produce quick results must depend upon the past performances in the particular town or city considering the problem.

Assuming that the getting of new business has not been followed in a systematic manner or perhaps not at all, and the results obtained meagre or not satisfactory, it will be necessary to make a fresh start. If the company does not possess a complete card index of the town, active young men of pleasing address should be sent out to make a building to building canvas to procure the data necessary to compile a complete card index showing the style of house, location, owner of same and his business, tenant and his business, whether the house is wired or piped, if the fixtures are in, and when possible, the feeling of the tenant toward the electric light company and the use of its current. These cards should also bear the date and the name of the canvasser. When the cards are carefully taken and properly filed, they form a true guide to the whole field desired to be worked for better and for more electric business.

After the card has been obtained a complete list should then be made from same, indicating the building, etc., that seem to offer the best opportunities for business. The town or city should then be divided into sections or districts, with the list of prospects located in each district and tabulated. The next problem is to secure a proper type of canvasser to solicit the business in each district, and this part of the central station scheme is a difficult one, for it is soon learned that good solicitors are hard to obtain, and it is acknowledged that a first-class canvasser, who can close good business every day, is one of the most important personages about the whole central station system.

A satisfactory method is to employ bright, energetic, clean-cut young men of pleasing address and courteous manner and carefully train them for the position of canvassers.

The new canvasser should be placed in the several departments of the company until he obtains a good insight into the requirements of first-class electrical service and thoroughly appreciates the necessity of observing the details that go to make up the satisfactory electric current he is to sell.

When the candidate has advanced far enough in the operating and complaint departments he should be turned over to the chief canvasser or other official who has charge of the new business department, to be further coached along the line of his duties and then sent out for a few days, in company with an experienced canvasser, that he may observe the method of approaching prospective customers, arguments used, etc. He should then be given a district and started off to produce the proper amount of profitable new business required of him.

In order to keep an accurate record of what each canvasser is doing, it is very necessary to have them fill out daily an accurate report blank, and these daily blanks must be correctly kept and the results obtained by each man should be tabulated each week, showing the names of parties called upon, number of contracts closed, reason for not closing all of them, amount of new business added to old customers, expense items, etc. From these weekly sheets may be readily learned the percentage of contracts closed to calls made, the cost per call, per contract closed, per kilowatt of new business obtained, or in any particular way the data may be desired.

These weekly sheets quickly indicate the men who are producing the business, and by properly alloting the districts, no trouble will be found in producing satisfactory results all around, and the canvasser who does not put in good substantial work in his district can not escape the weekly inquiry.

Each canvasser should be paid a definite weekly salary, and at the end of stated periods, should receive an additional recompense, in the way of commission or bonus, based on the value to the lighting company of the new business he obtains. Further rewards should also be offered to the canvasser making the highest record in a given time. The districts covered by the various men will indicate the proper method of handling this feature of the new-business department.

To facilitate the efforts of the canvassers, it is desirable, if possible, that a room be especially devoted to their use. Every morning, the first hour should be given over to the discussion of the past day's trials, troubles and tribulations and a full and frank talk on the best ways and means of obtaining better results and of avoiding past difficulties, should be engaged in by the respective canvassers and the chief canvasser, superintendent or whoever is responsible for the new business of the company. These meetings are a great help and with the proper man at the head of the canvassing department will fill the men with enthusiasm for each day's work.

To afford the canvassers and other men about the plant, as well, an opportunity for studying the theoretical as well as the practicable side of the business and make them better salesmen and workmen, every company should feel able to purchase a number of the best books published on the various branches of the business and also keep on file the leading electrical magazines, journals, etc.

The men should be encouraged in their desire for more knowledge of the business they are engaged in and nothing helps promote this spirit more than to have meetings in the evenings at regular intervals at which meetings a talk may be given by the superintendent or any man in the company who is capable of affording information along any line of the business.

Pertinent questions should be solicited

[1] Paper read before the Ohio Electric Light Association, Put-in-Bay, August 22.

from the men and all should feel that their interests and the lighting company's interests are the same. Efforts spent along these lines will be liberally repaid by the higher quality of work performed by the men and the larger amount of good new business obtained by the canvassers.

The number of canvassers that may be used to advantage will depend upon the locality and in some places it is found desirable to have special men in addition to the regular canvassing force. These special men may be experts along the line of electrical signs, cooking and heating apparatus, decorative and window lighting, power, etc., while in others the chief canvasser or superintendent is usually a man capable of looking after this special work.

To further facilitate the canvassers' work it is desirable to have advertising that will keep the lighting company's product constantly before the public. This result may be partly accomplished by the local newspapers and satisfactory space should always be purchased and attractive, timely copy inserted and frequently changed. The newspapers will also be likely to be friendly to your company if this medium is used.

To enable the canvasser to get to the man who is thinking about wanting electric current, the follow-up scheme of individual letters is a good one. These letters should be written in a clean-cut style with as few words as possible and sent to the merchant, manufacturer or tenant and enclosed with each letter a stamped return postal card ready for return if they are interested. These letters should be mailed to a well-selected list compiled from the card index and should be sent at intervals close enough to keep the matter ever before the prospect until he finally decides to investigate and returns a postal card and the canvasser's opportunity arrives.

All envelopes leaving the electric lighting company's office and going to consumers or others in the territory covered by your mains should always carry a dodger or booklet, relating to some appliance for the economical use of electric current, and the leading manufacturers of these appliances are now furnishing, gratis, quantities of their booklets with the lighting company's name printed on same.

All construction work, wagons, toolboxes, etc., should be properly decorated with banners or labels calling attention to the use of your product, and no opportunity should be lost sight of in keeping your commodity in the public eye.

A convenient and very satisfactory method of keeping before the public day and night is the use of prominent bill-boards in the various districts and have a concise advertisement printed on same and by means of trough reflectors illuminate the bill-board at night.

The use of electric signs for advertising the company's business is also a good means of burning the lighting company's product into the public mind. Both of these methods indicate to other advertisers the value of electrically lighted signs and bill-boards and indicate new business in this direction.

It is this publicity and constant pounding of the word "electricity" into the minds of the public that brings a central station business. When a manufacturer's steam plant breaks down and he wonders what he can do; when a kerosene lamp explodes and the user wants safer light; when the decorator sends in a large bill for retouching walls in a residence and the owner thinks of a light that will not smoke and disfigure paperings and tapestries, then it is that the constant hammering of these advertisements, letters and canvassers' efforts has its effect and the electric current its reward.

To assist the canvassers, exploit the use of current during the daylight hours, and it is well to arrange that they may offer appliances like electric sad-irons, sewing-machine motors, vibrators, etc., on a free trial basis for two weeks or more with the understanding that the appliance will give satisfactory and economical results during the trial and allow the customer the privilege of purchasing same at the end of the trial at about cost price or return to the company without expense if they are not satisfactory and merely pay for the current consumed during the trial. It is a fact that very few trial installations ever come back on the company.

It will be well to remember in this connection that a canvasser should see to it that the trial user thoroughly understands the proper use of the appliance, and the trial should be carefully watched to this end by the canvasser concerned.

With all the advertisement and follow-up systems, dodgers, bulletins, etc., it is necessary that the canvassers follow up every possible clew to new business and present the matter in the proper light personally, for there is nothing as good as the personal interview by a clever canvasser.

When new business has been obtained and connected to the lines the central station should then make the satisfactory service of the customer its particular object of attention.

A polite letter of appreciation should always be mailed to every new customer and enclosed with his approved copy of the electric current agreement, and the anxiety of the lighting company to give absolutely satisfactory service at all times and to every one on the line should be touched upon in this letter.

The canvassers responsible for the new business should inquire of the new user after it is in use a few weeks if everything is satisfactory and as represented, and also remind the customer that the company is always waiting to do the right thing if the service requires any attention from any cause whatever.

The complaint department of every lighting company bears a vital relation to the keeping of new business and the enlarging of the old business. Those in charge of the same should be diplomatic and courteous to a high degree and fully posted on the policy of the company. Telephone calls or complaints relating to the service should always be handled intelligently, promptly and courteously.

Every complaint received should be attended to at the earliest possible moment, and it should be the aim of every person connected with the lighting company to give the customer entire satisfaction.

This may be a difficult proposition in some instances, but it is a matter of record that special effort along this line always pays the lighting company, and too much stress can not be laid upon this particular point.

While this paper may not fit the requirements of all lighting companies, the scheme noted, enlarged or curtailed, as may be needed by the size of the district covered, will be found satisfactory. Human nature is nearly the same everywhere, and the central station man who will see to it that every person in his company, from the president down, studies the interests of the customers, attends to their complaints promptly and satisfactorily, renders honest and good service, properly rewards the canvassers who bring in the business, will soon find as much new business and enough enlargement of the old business as the most active electric lighting man can take care of in a rapidly growing power plant. In addition to this, think of the possibilities for a large business in any community served by a central station that has the confidence of the entire public and the business good will of the individual citizens.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

HCK Instantaneous Electric Water-Heater.

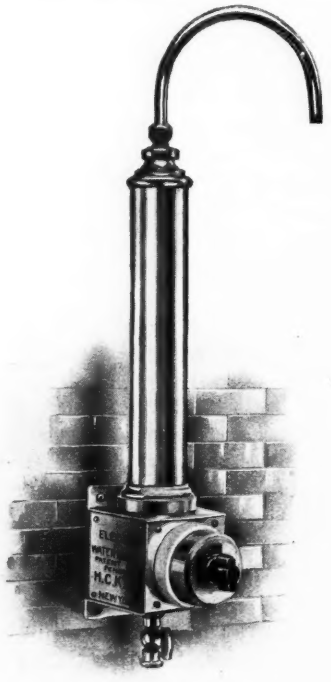
In the earlier type of electric heaters, the heating element, usually consisting of a resistance wire wound upon a suitable insulating frame, was placed within the tool or appliance to be heated. A certain amount of air space always surrounded the heating element, therefore the heat was never transmitted directly to the heating surface of the appliance. This indirect transmission of heat from the heating unit was found to be extremely inefficient, and the efficiency of the heater was further reduced on account of the limited temperature at which the resistance wire could be operated in the air.

Both the efficiency and the lasting qualities of the modern electric heating appliances have been materially improved by imbedding the heating element in an insulating compound which protects it from the atmosphere, permitting a much higher temperature than would be possible in the open air. The insulating compound, in addition to insulating and protecting the heating wire or strip, also serves as a much better medium than the air for transmitting the heat to the heating surface of the appliance, with which it is in direct contact.

Keeping the above in mind, and after considerable experimenting, and many tests conducted during the past year, the H. C. K. Company has produced a new form of electric heater for heating water instantaneously.

It was found during the tests that it would be impossible to heat water instantaneously by any other method than direct contact between the water and the heating element. This form of heater was then developed, but while the efficiency could be maintained extremely high and the heating of the water could be made as rapid as desirable, the life of the heating element depended altogether upon the presence of the water. The problem was solved when an automatic cutout was applied to the electric water-heater which would interrupt the current when the water ceased to flow, or if the flow should be reduced to such an extent that the water in the heater would boil.

At first sight, it might appear that the water flowing through the heater around the heating coil would introduce a ground on the electric system. This is, however, not the case, as insulating joints are provided at top and bottom of the heater tube and the resistance of the water is sufficiently great to prevent any flow of current. Where the heater is connected to the regular Edison three-wire system, the neutral, or grounded connection, is connected to the lower part of the heater, which absolutely prevents any grounds, as there can be no difference of potential.



HCK Instantaneous Electric Water Heater.

This is also the case where the heater is used on alternating systems where one side or the neutral of the secondary circuit is grounded.

The new instantaneous electric water-heater consists in the main of a supporting box, upon which is mounted a double-pole quick-break switch, an insulating joint of special design to the lower end of which is attached a one-quarter-inch water-valve. Screwed into the upper part of the insulating joint is a bronze fitting within which is placed the cutout which automatically opens and closes the electric circuit as the water is turned off and on. In the upper end of the bronze fitting there is held (in a similar manner as is a water-glass for a boiler) a porcelain tube, with one terminal at each end. Within the porcelain tube is placed the heating element, which consists of a specially designed spiral, made of a material which is guaranteed not to rust or corrode or be injured in any way by the action of the current and the presence of the water. At the upper end of the porcelain tube there is another bronze fitting with insulating joint above it which supports the spout. One wire leads from the switch to the upper bronze fitting on the porcelain tube, and the wire from the other side of the switch leads to the lower bronze fitting. The porcelain tube and the bronze fittings are surrounded by a brass tube, one and three-quarter inches in diameter. The total height of the heater from the bottom of the inlet valve to the top of the spout is twenty inches, and all fittings are nickel-plated and highly polished.

The device is ornamental and can be placed anywhere where an electric circuit can be installed.

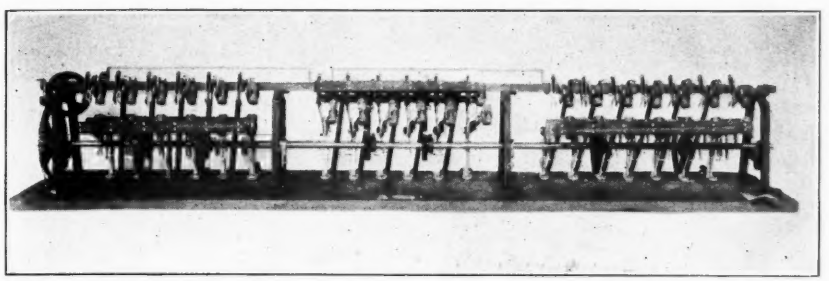
The heater can also be furnished in combination with a water-tank, to be placed slightly above it, in which case it is not necessary to connect the heater with the water system, only connecting it to the electric wiring by means of an attachment plug and flexible cable of the proper kind. Under this condition, the water-heater is portable and can be installed in any hotel room, where it can be attached to the ordinary washstand.

If the water-valve is open but the switch not turned on, cold water will flow from the heater. The moment the current is turned on the water becomes heated, and by regulating the flow of the water the heater can be adjusted up to 200 degrees Fahrenheit.

It is readily appreciable that on account of the electric current flowing through the water the heater also acts as a germ-killer, notwithstanding the fact that the water may not be brought up to any very high temperature.

The standard heater requires about ten amperes at 110 volts, and will heat a glassful of water to 190 degrees Fahrenheit in forty seconds, which at the rate of ten

cents per 1,000 watts would cost .014 cent. The same heater would heat one gallon of water to the same temperature in ten minutes for less than two cents. For an ordinary washstand there would be required about one quart of water at about 105 degrees Fahrenheit. The heater would require forty seconds to heat this water, and the cost would be less than .014 cent.



Flasher for Operating 1,050 Ten-Candle-Power Incandescent Lamps.

The absence of all odors, and the promptness with which the apparatus performs the work, should commend it for use in many places, a few of which may be referred to as follows: for hot drinks at soda fountains and cafés; hot water for barber shops, manicuring establishments, etc.; indispensable in hospitals, doctors' and dentists' offices for an instant supply of hot water for general use and for sterilizing instruments.

Hotels can use the instantaneous electric water-heater in many of the rooms for supplying hot drinking-water, and in rooms where there is no running water the heater can be installed in combination with the water-tank mounted above it. In this case the heater dispenses with the old-fashioned water-pitcher, and can be mounted on the washstand, discharging the water at any temperature directly into the washbowl. The cost of installing the HCK system is less than piping a building for hot and cold water, and the increased revenue possible will soon pay for the installation.

In the home and summer cottage the heater is most convenient for all supply of hot water. Where there is a warm-water supply the heater is installed for all quick service and for drinking purposes.

The new electric heater is made in several sizes, from ten to twenty-five amperes at 110 volts and five to twelve amperes at 220 volts, for either direct or alternating current of any frequency. The ten-ampere size will heat one glass of water to 190 degrees Fahrenheit in forty seconds, and the twenty-five-ampere size will heat one glass of water to the same temperature in fifteen seconds.

A Large Electric Flasher.

The illustrations appearing herewith will give a very good idea of what is probably the largest load handled by a flasher in the country at the present time, and very likely the only one of its kind in existence in the matter of voltage.

The work consists of two signs, the upper of which is single-faced, about ten by fifty feet in size, and is intended to be observed principally by passengers on the Union Loop, Chicago, Ill. This loop is used by all the elevated railroads in that city.

The sign projecting over the sidewalk is about twenty feet from the ground, over the main doorway of the terminal station of the Aurora, Elgin & Chicago Railway. It is double-faced, and visible for long distances both north and south on Fifth avenue. The upper sign is on the roof of the terminal station, which is below the elevated structure. The two signs combined contain about 1,050 ten-candle-power lamps, wired in series of fives. Sixteen-inch letters are used throughout. The three signs are divided into forty-two circuits, twelve circuits constituting the north side of the projecting sign, twelve circuits the south side of the projecting sign and eighteen circuits for the large sign on the roof. The signs have a metal background, painted black, and the letters are wood and metal combined, with a white-enameled face and red edge.

There are two sets of enclosed fuse cutouts, one on the live side and the other on the ground side, both in iron-lined boxes, about one foot wide by six feet long. One of these cutout boxes is shown projecting below the bottom of the roof sign, and the other lies on the roof behind the flasher case, which also is shown below the upper sign. Inside the cutout cabinet, twelve of the fuses are bunched together on the live side and lead to the flasher, twelve more are bunched in another group and lead to another section of the flasher, and the other eighteen are bunched in a third group, leading to the remaining section of the flasher. All wiring is in iron conduit throughout the work.

The flasher case is about seven feet long, twenty-four inches high and eighteen inches deep, has a sloping roof covered with galvanized iron and is weatherproof throughout. Inside it is lined with asbestos, which in turn is covered with galvanized iron. It opens from the front with a hinge door that drops down its entire length and is mounted on a light trestle about four feet high placed on the roof.

Two Large Flashed Signs, Containing 1,050 Ten-Candle-Power Incandescent Lamps.

The flasher is known as a No. 3110 Dull's series carbon flasher and was made by the Reynolds-Dull Flasher Company, 177 Adams street, Chicago, Ill. Although

the illustration seems to indicate a large number of switches, there are only three switches proper, having six, six and seven blades respectively. Each gang of blades is worked in unison, that is, there is one common yoke connecting them together in such manner as to cause all in each gang to be raised and lowered simultaneously by means of two cams on the main shaft. The diagonal bus strips shown in the back of the flasher are for connecting the various single switches of the gang in series. The current is taken in on the upper half of the left-hand switch and then travels through each individual blade in series before being taken out at the lower half of the switch on the right-hand side of the gang. Thus it will be seen that the current travels through six blades mounted together and connected in series. When the gang switch drops to open the circuit the current is broken by six air-gaps at once. The three group switches are operated by cams which are one-half of a circle and raise and lower the blades in succession, giving the following sequences: the large sign on the roof is thrown on, and before that goes out the north side of the projecting sign is thrown on. Before the latter goes out the south side of the projecting sign is thrown on and the large sign is thrown off, and the large sign is thrown on again before the south side of the projecting sign is thrown off. This gives a light on the sidewalk equivalent to one and one-half signs burning at all times and effects a flat saving of fifty per cent in current, at the same time giving twenty-four changes per minute in the three signs to attract attention.

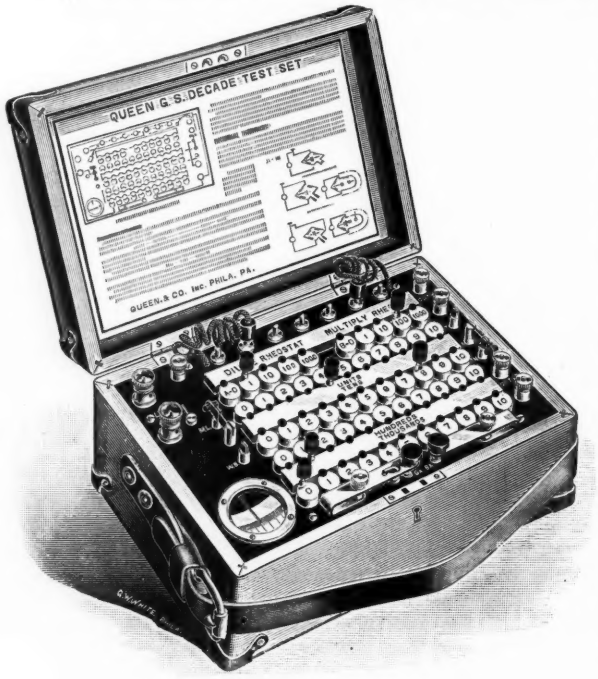
An excellent feature in connection with the operation of this flasher is as follows: When the service switch is thrown off slowly it will hold an arc four inches long, but when the flasher opens the same circuit it will not hold an arc on the gang switches greater than three-sixteenths of an inch, or, a total of one and one-eighth inches in the flasher will break the arc perfectly, while the service switch will hold the arc for the same load at more than three inches.

The flasher itself is twelve by fifty-six inches on the base, ten inches high, and is driven with a one-twentieth-horse-power, 110-volt motor, in series with four sixteen-candle-power lamps. While the flasher at present is handling 1,050 ten-candle-power lamps at 600 volts, its construction is such that any number of lamps can be added up to a total of 5,000 four-candle-power lamps or the equivalent.

New Navy Department Test Set.

The Queen G. S. portable test set illustrated herewith is a type recently put on the market to meet the revised Navy Department portable testing set specifications, which have been altered considerably and made much more exacting than heretofore.

The arrangement of this set has therefore been made with not only these specifications in mind, but also with a view to securing the maximum portability with due regard to convenience in mechanical arrangement, while the connections of circuits are such that a large variety of tests



QUEEN G. S. PORTABLE TEST SET.

beyond those indicated in the government specifications may be executed. It, therefore, forms an ideal set for the use of telephone and telegraph companies, electric light and power stations and electrical engineers who find it necessary to make a wide variety of measurements and prefer one complete testing instrument to a large number of individual pieces.

It consists in general of a Wheatstone bridge with a 1, 10, 100 and 1,000-ohm coil in each arm. The rheostat consists of ten coils of units, tens, hundreds and thousand denominations, the last or tenth coil being added for convenience in checking up the next higher series of coils; that is, the ten coils in the unit row in series can be checked with the first coil in the ten row, and likewise the tenth ten-ohm coil can be checked against the first 100-ohm coil, etc.; an operation which confirms the accuracy of adjustment, but one not possible to execute in a decade set where each row consists of but nine coils.

The bridge and rheostat are properly connected to an improved D'Arsonval galvanometer, dead-beat and of such high sensibility that a change of one-tenth of one per cent in the rheostat when measuring resistance of approximately 1,000 ohms value will give a decided galvanometer deflection. The needle is free from outside magnetic influences and so balanced that the test set can be used in practically any position; it is also provided with an adjustment lever so that the pointer of the galvanometer can also be made to indicate zero.

The battery consists of six chloride of silver cells connected so that any one or number up to six in series may be used, while a pair of binding-posts allows the use of an outside battery when desired.

Both the galvanometer and battery keys are on the front of the case in a most convenient location, and are made extra heavy with a liberal supply of platinum iridium at the actual contact points.

Binding-posts and a small switch allow the use of an outside galvanometer if desired.

A ground-post, as well as an auxiliary galvanometer switch, is provided so that both the Murray and Varley loop can be executed. The resistance coils in the bridge arms are adjusted to an accuracy of one-twentieth per cent while that of the rheostat coils is one-tenth per cent, the wire used being manganin and having a negligible temperature coefficient; all the spools being well shellacked, properly baked and aged before standardizing. To the hard-rubber plate, which is highly polished and of exceptionally good quality, are securely fastened the resistance coils, galvanometer, battery, etc., so that by removing this plate all interior parts are out at the same time.

The individual cells of battery can be removed by unscrewing a small section of the bottom of the case, which exposes them to view, when the connections can be easily loosened and new cells inserted should this be found necessary.

The overall dimensions of the set are

approximately twelve by eight by six inches, and the weight is about twelve pounds, the case being made of polished quartered oak, and protected with nickel-plated brass corner-pieces.

In addition to the usual measurements of resistance, this set can be used for locating grounds, crosses and other cable troubles utilizing either the Murray or Varley loop tests, while it can be used for insulation resistance measurements and numerous other tests, such as checking up voltmeters and ammeters, measuring battery resistance, etc.

The instrument is manufactured by Queen & Company, Incorporated, Philadelphia, Pa.

Results Obtained by the General Electric Company's Automatic Feeder Regulator.

The accompanying diagrams illustrate in a most interesting way the voltage regulation obtained by means of the BR type of automatic feeder regulator manufactured by the General Electric Company. The construction and operation of this type of regulator, as well as the type 1R automatic regulator made by the same company, have been described at length in this paper.

In principle the BR regulator is a variable ratio transformer or compensator having two separate windings. The primary or shunt winding is connected across the line, while the secondary or series winding is arranged in series with the line to be controlled, the regulator being connected between the generator and the load. Voltage is maintained constant by automatically changing the ratio of turns on the transformers and thus boosting or lowering the voltage to compensate for the fluctuations taking place when very heavy power service draws large momentary currents over the alternating-current feeder circuits.

The close regulation that is obtained with these regulators is seen by comparing Fig. 1 with Fig. 2. The charts were taken simultaneously with two Thomson curve-drawing voltmeters, one on either side of a type BR regulator designed to boost or lower the voltage ten per cent. The generator voltage (Fig. 1) was purposely varied over a wide range, so that the conditions are more severe than those usually holding in actual service.

In both charts the clearly defined record given by the Thomson curve-drawing instruments is well exemplified. The instruments used in taking these records were equipped with twenty to one ratio potential transformers. Therefore the voltage variations illustrated represent the actual voltage regulation obtained at the lamps when the feeder circuit is 2,300 volts, since the ratio of transformation between the feeder circuit and the lighting circuit is the same as the ratio in the potential transformers, twenty to one.

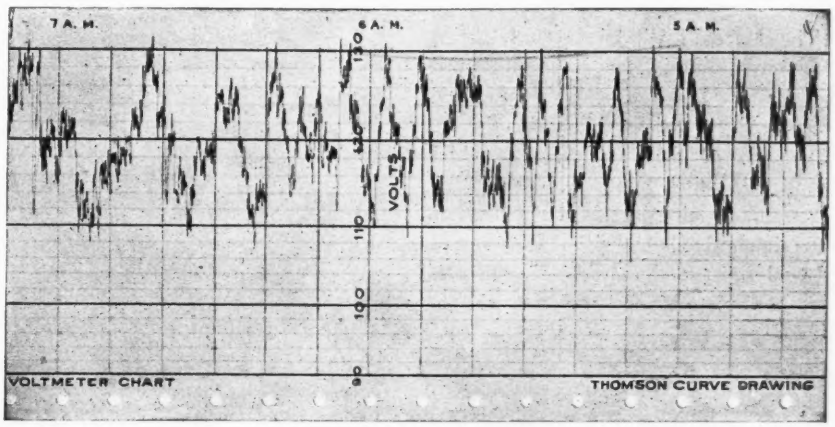


FIG. 1.—CHART SHOWING VOLTAGE VARIATIONS.

It will be noted that the actual maximum voltage variation on the generator side, during the total time of the run, was 508 volts, or approximately 22.1 per cent of the normal generator voltage, 2,300; whereas on the feeder side of the regulator the maximum voltage variation is held down by the regulator to approximately forty volts, or 1.7 per cent. This is true except at one point where the voltage variation was allowed to exceed the capacity for which the regulators were designed, as shown by inspection of the two charts. The point of minimum voltage (106) recorded at 5-09¾ on the chart of the generator side of the regulator (Fig. 1) is about 1.3 volts beyond the boosting capacity of the regulator, as indicated by the drop at the corresponding point on the chart of the feeder voltage. The apparent discrepancy in time is accounted for by the fact that the chart of the feeder side was started slightly ahead of the chart on the generator side of the regulator.

The practical result of this demonstration is the fact that a steady light can be obtained with incandescent lamps on a feeder circuit which also supplies power for heavy motor service. Not only will the regulators maintain a uniform illumination, but since the lamp voltage is practically constant the life of the lamp is greatly increased. Both the BR and the IRS types of regulators are built in standard sizes for cycles to boost and lower the voltage either five per cent, seven and one-half per cent or ten per cent above and below normal. The BR regulator is usually built in sizes from eleven kilowatts to twenty-two kilowatts, while the IR types for single or polyphase circuits range in standard sizes from 5.5 kilowatts to forty-four kilowatts. Their capacity, however, is practically unlimited and has

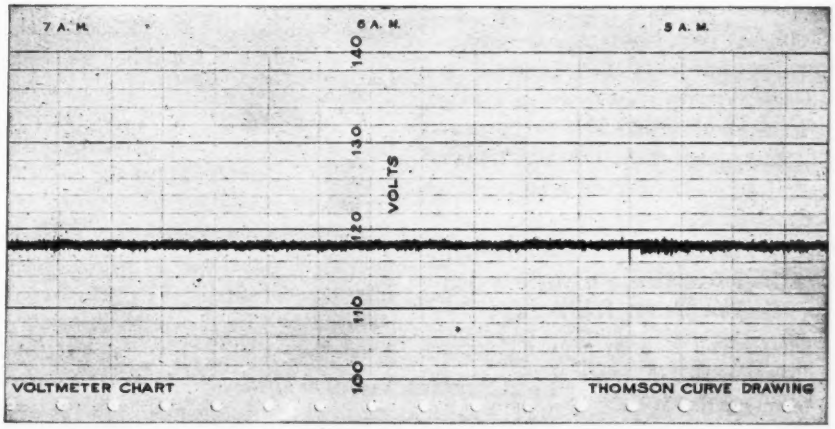
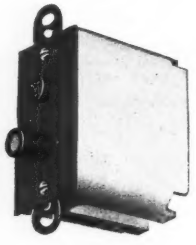


FIG. 2.—CHART SHOWING REGULATION—READING SIMULTANEOUS WITH THAT SHOWN IN FIG. 1.

already been extended to 800 kilowatts. The General Electric Company is also prepared to furnish automatic regulators of the same general construction as the standard types but wound for special voltages and frequencies.

New Design of Push-Button Switch.

The Marshall Electric Manufacturing Company, Boston, Mass., has recently perfected a new design of push-button switch. The novelty consists chiefly in the arrangement of the lug fastening which adapts this switch to all standard conduit boxes and permits the use of the Marshall and standard plates without alteration. The chief feature, however, is the patented fibre false plate which is sent out with all



Ten Ampere D. P. Push-Button Switch.

of these switches, protecting the switch mechanism from all plaster and dirt, which is a great source of switch trouble while the building is being finished and before the permanent plates are attached. This feature has been highly recommended by prominent architects and engineers.

These switches are carried in stock at the New York office, 227 Fulton street, and the Chicago office, 169 Adams street, as well as at the Boston works.

The "Young" System of Signaling for the Philadelphia & Western Railway.

The General Railway Signal Company has been awarded the contract for the complete automatic block signal equipment for the Philadelphia & Western Railway. This road runs from the terminus of the Philadelphia subway elevated structure, parallel to the Pennsylvania Railroad mail line, due west for twelve miles. The road is double track, but the right of way provides for four tracks eventually.

Signals will be spaced one and three-quarters miles apart, and all signals will be provided with an overlap of about 2,000 feet.

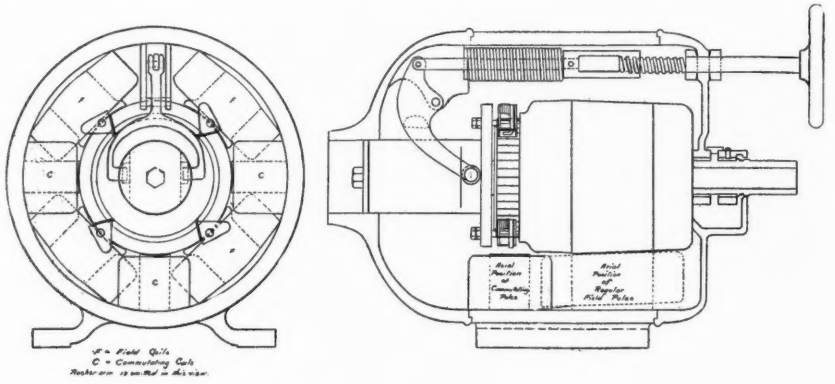
With the system to be installed on the Philadelphia & Western Railway an alternating current is used to supply the track circuits, and inasmuch as the transformers used for this purpose have an unlimited amount of power back of them, it has been found possible, where alternating-current track circuits are used, to operate blocks three miles in length, without cutting the section. It is essential in interurban roads operating on say five to ten minutes' headway to extend the length of the blocks from a mile and a half to two or even three miles in length, and this is made possible by the development of this alternating-current system. If the system were limited to short sections, as on steam roads, the cost of cutting these sections, involving the use of additional reactance bonds, etc., would in a way be prohibited.

The two-rail system will be employed; that is, both of the traffic rails will be available for the return of the propulsion current.

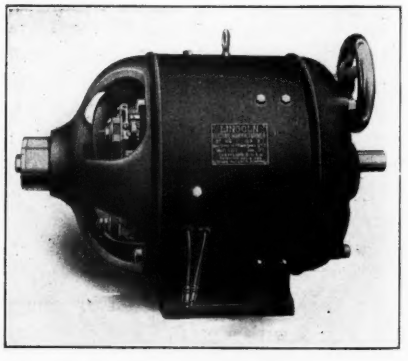
The alternating current for the operation of the signal system will be obtained from transformers in the main generating station, stepping down from 19,000 to 2,300 volts. This current is carried by a special transmission line the entire length of the road, and at signal locations this 2,300-volt current will be further reduced to fifty volts, which in turn will operate the track circuits, signal motors, signal lamps, relays, etc. While the main transmission line of the road is twenty-five cycles, the signal apparatus will also be operated at twenty-five cycles, the same as is being done by the General Railway Signal Company in its installation for the New York Central & Hudson River Railroad electric zone installation.

The Lincoln Variable-Speed Motor.

The Lincoln Electric Manufacturing Company, Cleveland, Ohio, has placed upon the market a variable-speed motor for which a wide variation in speed is claimed. The company asserts that with the peculiar design of this motor it is possible to obtain ranges in speed variation as high as ten to one. The design of the motor provides for the withdrawing of the armature from the influence of the field poles, decreasing the field area and magnetic flux, increasing the air-gap and resistance, permitting an increase in speed. A conical armature is used which gives a rapid increase in the air-gap and a greater increase in speed for a given lateral adjustment than is possible with a cylindrical armature.



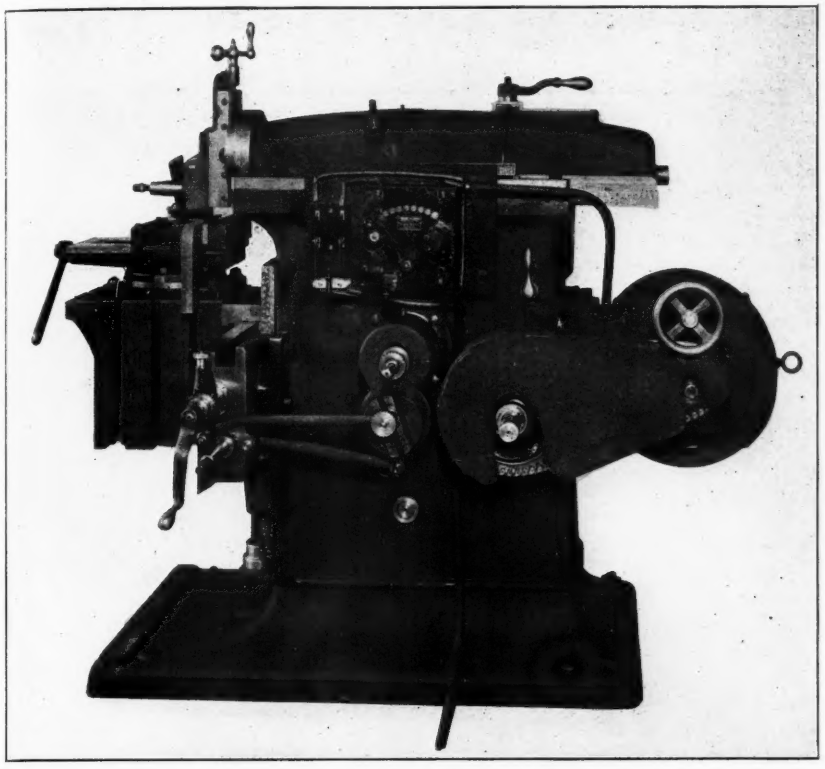
Sectional View of Lincoln Variable-Speed Motor.



Lincoln Variable-Speed Electric Motor.

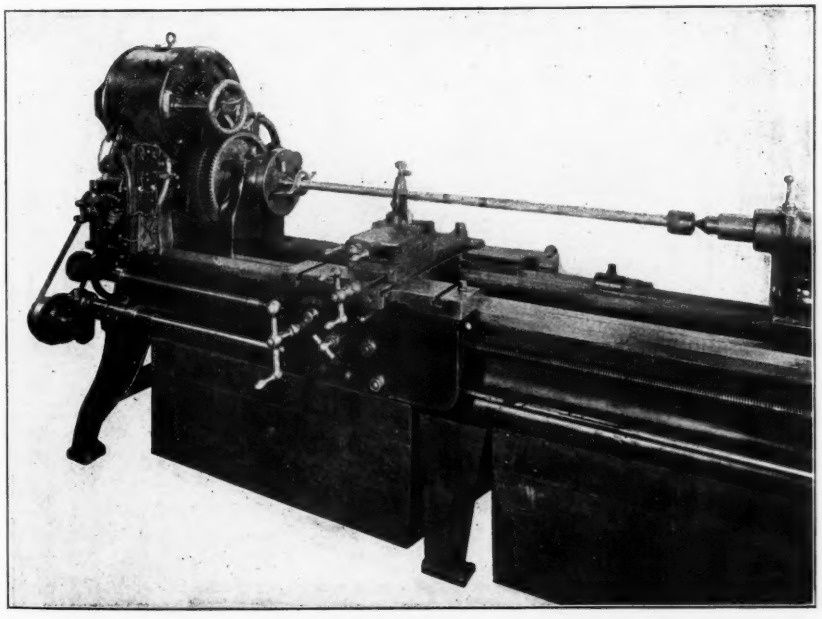
To accomplish this the company has perfected a thrust bearing which supports the commutator end of the armature, carrying an annular ball bearing to take both thrust and radial loads. The thrust bearing is actuated by a split lever having a central pull on opposite sides of the bearing, the movement of the lever being accomplished by means of a screw mechan-

ism and hand wheel. This is well shown in the accompanying illustrations. A spring around the lever connecting rod is so adjusted as to balance the magnetic pull of the armature.



LINCOLN VARIABLE-SPEED INDUCTION MOTOR, MOUNTED ON SIXTEEN-INCH SHAPER.

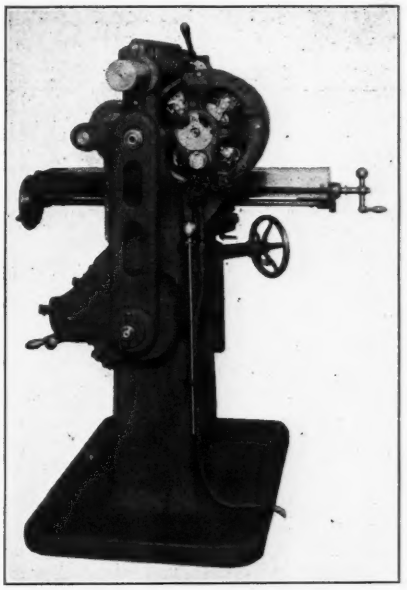
So far as installation is concerned, the machine is a two-wire, direct-current, shunt-wound motor. This system admits of speed variation inside the motor, doing away entirely with a controller and its accompanying resistance. The speed variation is under the immediate control of the machinist, who can secure any increase or decrease in speed that the work in hand may demand.



LINCOLN VARIABLE-SPEED INDUCTION MOTOR, MOUNTED ON TWENTY-INCH REED LATHE.

The efficiency claimed is high, comparing favorably with good constant-speed motors. The efficiency at full load on a five-horse-power, five-to-one motor is said to show by test from eighty-six per cent at 300 revolutions per minute to seventy-five per cent at 1,500 revolutions per minute.

The perfection of this motor was attended with more than ordinary difficulty. Its practicability is based upon its record in actual operation. Every feature—the thrust bearing; the special commutating field, into which the armature is drawn at high speeds to ensure sparkless commutation from no load to fifty per cent overload; and the sleeve which carries the pulley or pinion, allowing the armature to slide through it in its lateral adjustment—were all tested and tried and proved efficient before the motor was placed upon the market. An additional claim which the manufacturer makes is that the motor will run in either direction, a simple reversing switch being all that is necessary as an auxiliary attachment.



LINCOLN VARIABLE-SPEED INDUCTION MOTOR ON UNIVERSAL MILLING MACHINE.

An Apprenticeship Course as a Preparation for Engineering Activity.

An address was delivered on August 30 before the engineering apprentices of the Bullock Electric Manufacturing Company, at Cincinnati, Ohio, by Professor V. Karapetoff, of Cornell University. The topic taken was "An Apprenticeship Course as a Preparation for Engineering Activity." The speaker called attention to the three essentials for a successful engineer—professional knowledge, knowledge of business forms and of human relations, and strong character. He enlarged upon these ideas, giving the apprentices a large amount of instructive and valuable information and advice. Among the suggestions made were the keeping of careful notes, reading the current engineering journals and standard engineering books. He also advised the apprentices to undertake original investigations whenever opportunity offered. Some suggestions were made to assist them in their study of men and business methods.

Current Electrical News

DOMESTIC AND EXPORT.

FIRST EARTH TURNED FOR NEW YORK-CHICAGO AIR LINE—President Alexander Miller, of Chicago, on September 1, turned, with a silver spade, the first earth in the construction of the New York-Chicago electric air line at Laporte, Ind. A party of 300 Chicago railroad men and investors witnessed the ceremony.

LEWISTON & SOUTHEASTERN ELECTRIC RAILWAY COMPANY—The stockholders have authorized the directors to issue first mortgage five per cent bonds to the amount of $3,000,000 on the Lewiston & Southeastern Electric Railway Company, and $2,000,000 on the Central Idaho Development Company. The Scofield Company, of Philadelphia, Pa., has the contract to build 100 miles of line between Lewiston and Grangeville, Ida. Work will begin the coming fall.

REORGANIZATION OF THE INTERSTATE TELEPHONE COMPANY, OF TRENTON, N. J.—As a part of the reorganization plans of the company, a deed transferring the property of the Interstate Telephone Company, of Trenton, N. J., from the trustee in bankruptcy for the Court of Chancery has been filed in Paterson, N. J. The consideration mentioned in the deed is $575,000. The second mortgage is drawn in favor of the Mercer Trust Company, and is a general mortgage securing a loan of $4,000,000.

ANNUAL REPORT OF THE BROOKLYN RAPID TRANSIT COMPANY SHOWS A NET GAIN OF TWENTY-THREE PER CENT—The annual report of the Brooklyn Rapid Transit Company for the fiscal year ending June 30 last shows gross earnings for the year of $18,473,328. This compares with a gross of $16,333,444 in 1905. Net earnings for the last year were $8,031,950, against $6,529,574 in 1905. The surplus for the year, after all charges and appropriations, was $2,075,562, against $984,723 in 1905. The gain in gross for the year was 13.1 per cent, the increase in net being twenty-three per cent. The decrease in operating expenses was 3.5 per cent.

PLANS COMPLETED FOR TAKING OVER CANTON-AKRON TRACTIONS—Plans to finance the purchase of the Tucker-Anthony lines by the Northern Ohio Traction and Light Company have been completed, and the system will be taken over at a meeting of the stockholders September 18. The stock of the Northern Ohio Traction and Light Company will be increased from $7,500,000 to $10,000,000, of which $1,038,000 will be issued to exchange share for share for the common stock of the Canton-Akron line. The rest of the financing will be done by the Canton-Akron Consolidated Railway Company, whose capital stock will be increased from $10,000 to $2,500,000.

NEW UTAH POWER COMPANY—Articles of incorporation of the Salt Lake Public Service Corporation have been formed. The company has a capital of $3,000,000, and takes over the light, heat and power franchise granted by the Salt Lake City, Utah, council to J. S. Manley and L. H. Curtis. The officers are: James J. Chambers, president; John W. Dages, vice-president; J. S. Manley, secretary; E. M. Fullington, treasurer. Work has already been commenced, and it is expected that $1,000,000 will be expended within the next ten months. In addition to supplying light and power to Salt Lake City, the company will operate in Park City, Alta and several other mining towns.

MERGER OF CALIFORNIA POWER PLANTS—The Ventura County Power Company has been formed to take over the Ventura Water, Light and Power Company, the Oxnard Light and Power Company and the Santa Paula Electric Company. The capital stock of the new company is $2,500,000, and the officers are: J. A. Driffill, Oxnard, Cal., president and general manager; J. S. Torrance, Pasadena, first vice-president; W. R. Staats, Pasadena, second vice-president; James R. Martin, Los Angeles, secretary; T. E. Walker, assistant secretary; James A. Donlon, treasurer. The combination will permit the extension of the systems throughout the country surrounding Ventura, Oxnard and Santa Paula.

TO BUY CHICAGO TRACTION—A plan is under way to effect an organization of bondholders of the underlying companies to purchase the street railway lines of the Chicago Union Traction Company. It is the intention of the organization to take a twenty-year franchise from the city. The corporation is said to represent the holders of $1,000,000 bonds of the North and West Side companies, and has been chartered as the Chicago Street Railway Company, capitalized at $5,000. Chicago traction men are skeptical of the bondholders' scheme, and announce that this new move on the part of the minority bondholders is not big enough to interfere with the reorganization plans now being worked out in New York.

FEDERAL POWER PLANT PLANS—J. G. White & Company, of New York city, have been appointed consulting engineers to the government for the design of the new power plant of the Congressional group of buildings at Washington. This group includes the Capitol, the new House and Senate office building and the Congressional Library. The plant will supply light, heat and power to all the buildings on and adjoining the Capitol grounds, and will have a capacity of 14,000 horse-power. Bids were first advertised for and received September 30, 1905. On July 2 of this year these first bids were rejected, and J. G. White & Company retained to draw new plans. When these are completed new bids will be received.

NEW RAILROAD TO CROSS LONG ISLAND—Application has been made for a franchise for a cross-island trolley extension of the Huntington Railroad Company to run from the Huntington station of the Long Island Railroad, the present terminus of the Huntington Railroad, to Babylon, Farmingdale and Amityville, a distance of about twenty and one-half miles. The building of this line, which is virtually a Long Island Railroad enterprise, is one of the most important railroad extensions on Long Island. The line will be constructed in a thorough manner throughout, with heavy rails and substantial and modern electric equipment. The motor-cars, it is said, will be capable of a high rate of speed, and the whole enterprise will involve an expenditure of from $400,000 to $500,000.

CHEAPER GAS AND ELECTRICITY FOR SYRACUSE, N. Y.—The state gas commission, on September 6, announced its decision on the complaint against the Syracuse (N. Y.) Gas Company, requesting a reduction in the charges for gas and electricity in that city. The commission reduced the price of gas from $1 to ninety-five cents per thousand feet after October 1, and the charge for arc street lamps from $85.75 per lamp per year to $68. Commercial incandescent lighting rates are reduced, after October 1, for a year, from twelve cents per kilowatt-hour, with two cents discount if paid before the fifteenth of the month, to nine cents. After October 1, 1907, this is to be further reduced to eight cents. The decision in the Syracuse case is thought to foreshadow the commission's decision on similar complaints in other cities, including Rochester, Albany and Buffalo.

NEW NEW YORK POWER COMPANY—The New York & Ontario Power Company, of Waddington, St. Lawrence county, N. Y., has been given a hearing by the state gas commission on its application for consent to begin business by issuing $2,000,000 stock and $2,000,000 of bonds. The company announces that if it is authorized to do business it intends to supply Waddington, Lisbon and Ogdensburg with electric light, heat and power; to supply power for paper mills, and to send power two miles across the St. Lawrence river to Canada, to operate Canadian tin-plate and sheet-steel plants in Morrisburg, Ontario. In the purchase of the electric power rights at Waddington and in the development of the

facilities there the company expects to expend $3,500,000. It has a property valued at from $4,000,000 to $5,000,000. The plant will develop 30,000 horse-power.

MORE POWER FOR SAN FRANCISCO—Plans are under way for financing a project for utilizing water-power facilities in California, including the formation of a California company to be known as the Feather River Power Company, with an authorized capital of $25,000,000. This company is to take over the stock of the Eureka Power Company, the Golden State Power Company and the Western Power Company, of California, the stock of the Feather River Power Company to be held in turn by the Western Power Company, of New Jersey, which was incorporated on August 21. The Western Power Company, of New Jersey, is to have an authorized capital of $18,000,000, of which $6,000,000 will be preferred stock. In the plan as outlined the Feather River Power Company is to issue $25,000,000 of first mortgage five per cent gold bonds, to be secured by a first mortgage lien on the properties of the several power companies. The syndicate managers are: Edwin Hawley, F. H. Ray, J. N. Wallace, A. C. Bedford and Philip Stockton, of Boston, Mass.

ELECTRICAL SECURITIES.

While an irregular and unsettled condition existed apparently in the stock market last week, it is held in many quarters that the stability of the market is beyond question and that it has displayed remarkable resistance to what might easily be construed as adverse tendencies. The general average loss has been very small in the face of a monetary stringency, the rates going as high as 40 per cent. While the money market has checked the bull campaign, it is not likely that this will be in any wise permanent. The assistance rendered by the secretary of the treasury and the loosening of the foreign money market have brought about a favorable tendency which will, no doubt, be followed by increasing confidence and the releasing of money now held in reserve. The reports of leading industrials continue highly favorable, particularly the local tractions. Much satisfaction is found in the report of the Brooklyn Rapid Transit Company for the year ending last June, showing a gain of 23 per cent in net earnings. Indications are also at hand of further expansion in the iron and steel trade. The likelihood of a pacific condition in the coal trade, and, in fact, the general disposition to harmonize capitalistic and labor interests bid fair to make the coming fall and winter the most notable in the history of the country.

ELECTRICAL SECURITIES FOR THE WEEK ENDING SEPTEMBER 8.

New York:	*Closing.*
Allis-Chalmers common	18⅞
Allis-Chalmers preferred	44¾
Brooklyn Rapid Transit	81⅝
Consolidated Gas	139
General Electric	166
Interborough-Metropolitan common	38⅞
Interborough-Metropolitan preferred	79
Kings County Electric	160
Mackay Companies (Postal Telegraph and Cables) common	73⅜
Mackay Companies (Postal Telegraph and Cables) preferred	71
Manhattan Elevated	146
Metropolitan Street Railway	106
New York & New Jersey Telephone	125
Western Union	91
Westinghouse Manufacturing Company	150

During the seven months of the General Electric Company's fiscal year now ended, the volume of new business has been unprecedented and indicates a total for the fiscal year of between $55,000,000 and $60,000,000.

Directors of the Interborough Rapid Transit Company have declared the regular quarterly dividend of 2¼ per cent on the stock. The dividend is payable October 1 to voting trust certificates of record on September 17. Books close September 17 and reopen October 1.

The regular quarterly guaranteed dividend of 1½ per cent on Manhattan Railway is payable on October 1. Books closed September 14 and will reopen September 26.

The annual report of the Allis-Chalmers Company for the year ended June 30 shows as follows: profits on operation, $648,161; maintenance, depreciation, etc., $1,036,583; operating deficit, $388,422; balance brought forward, $545,903, leaving a surplus of $157,481. At the meeting of the company directors were reelected.

Directors of the Interborough-Metropolitan Company have declared the regular quarterly dividend of 1¼ per cent on the preferred stock, payable October 1. Books closed September 10 and will reopen October 1.

Boston:	*Closing.*
American Telephone and Telegraph	139
Edison Electric Illuminating	237
Massachusetts Electric	73
New England Telephone	129
Western Telephone and Telegraph preferred	87

It is now estimated that Massachusetts Electric will show gross earnings of about $7,400,000 for the fiscal year ending September 30, 1906, as compared with $6,665,528 last year. Earnings for July and August have run approximately 10 per cent ahead of those for the corresponding period a year ago, and if September brings favorable weather the earnings for that month should increase by the same amount. How much of the increase for the entire year will be available for dividends it is impossible to say, as there is no means of figuring out what amount the management will appropriate out of earnings for improvements. In the event, however, that such expenditures bear the same relation to gross that they did a year ago, the surplus should be in the neighborhood of $1,050,000, which is equivalent to $227,704 in excess of the total dividend requirements on the preferred stock for one year.

There is reason to believe that American Telephone and Telegraph stock will be placed upon a straight 8 per cent basis at the next meeting of the directors, which will be held on September 19, or in December. Telephone dividends are now declared, 6 per cent regular and 1½ per cent extra per annum. Earnings of the company are now at the rate of about 13 per cent per share per annum.

Philadelphia:	*Closing.*
Electric Company of America	11
Electric Storage Battery common	70
Electric Storage Battery preferred	70
Philadelphia Electric	8⅜
Philadelphia Rapid Transit	29
United Gas Improvement	86
Chicago:	*Closing.*
Chicago Telephone	120
Chicago Edison Light	140
Metropolitan Elevated preferred	66
National Carbon common	85
National Carbon preferred	119
Union Traction common	5
Union Traction preferred	20

Union Traction preferred advanced 2 points on the belief that the Mueller certificates will be pronounced illegal.

The directors of the South Side Elevated have declared the regular quarterly dividend of 1 per cent, payable September 29. Books close September 18 and reopen October 1.

DATES AHEAD.

American Electrochemical Society. New York city, October 8 and 9.

American Electro-Therapeutic Association. Philadelphia, Pa., September 18-20.

American Institute of Electrical Engineers. New York city, September 28.

American Society of Municipal Improvements. Birmingham, Ala., October 2-4.

American Street and Interurban Railway Engineering Association; American Street and Interurban Railway Association. Columbus, Ohio, October 15-19.

Colorado Electric Light, Power and Railway Association. Denver, Col., September 18, 19 and 20.

Empire State Gas and Electrical Association. New York city, October 12.

Illinois State Electrical Association. Springfield, Ill., September 19-20.

Kansas Gas, Water and Electric Light Association. Lawrence, Kan., October 16-17.

Michigan State Electric Association. Grand Rapids, Mich., October 10-12.

Old Time Telegraphers and Historical Society. Washington, D. C., October 9, 10 and 11.

Order of the Rejuvenated Sons of Jove. Boston, Mass., September 20.

Pacific Coast Gas Association. San Francisco, Cal., September 18-20.

Railway Signal Association. Annual meeting, Washington, D. C., New Willard, October 16, 17 and 18.

PERSONAL MENTION.

MR. L. P. SAWYER, manager of the Buckeye Electric Company, Cleveland, Ohio, was a Chicago visitor last week.

MR. J. M. BROUCHER, of the Brownell Company, Dayton, Ohio, has been appointed assistant general manager of sales for the Atlas Engine Works, Indianapolis, Ind.

MR. NORMAN G. KENAN has been elected president of the Union Gas and Electric Company, which is now operating the plants of the Cincinnati Gas and Electric Company.

MR. B. ROSENDORN, Selma (Cal.) agent for the San Joaquin Light and Power Company, has been promoted to the position of general solicitor, with headquarters at Fresno, Cal.

MR. SAMUEL C. SCHAFFNER, formerly engineer and general manager of the Illuminating Company, of Mobile, Ala., has joined the engineering staff of H. M. Byllesby & Company, Chicago.

MR. WALTER H. WHITESIDE, president of the Allis-Chalmers Company, has been elected a director of the company, filling the vacancy caused by the resignation of Mr. James Stillman.

MR. R. G. HUNT, formerly manager and engineer of the San Diego Consolidated Gas and Electric Company, has joined the engineering staff of H. M. Byllesby & Company, and will be located at their Chicago offices.

MR. ARTHUR REYNOLDS, who for a number of years was superintendent of the Lewiston, Brunswick & Bath Railroad, has been appointed superintendent of the Portland & Brunswick Street Railway Company, with headquarters at Portland, Me.

MR. GEORGE F. MADDOCK, formerly general superintendent of A. L. Ide & Sons, Springfield, Ill., and for some time past practicing consulting engineer with offices in Marquette Building, Chicago, has joined the engineering staff of H. M. Byllesby & Company, Chicago.

MR. O. A. FARRAR, formerly engineer of Allis-Chalmers Company, has joined the engineering staff of H. M. Byllesby & Company, and has charge of the reconstruction work of the large modern electric lighting plant which H. M. Byllesby & Company are constructing at Mobile, Ala.

MR. WILLIAM M. BRODIE has been appointed manager of sales of the Edison Manufacturing Company, Orange, N. J. Mr. Brodie has been connected with the Edison company for the past six years in the manufacturing department, and is therefore thoroughly familiar with the Edison battery. Mr. Brodie succeeds Mr. William S. Logue, who died last April.

MR. HOWARD E. TROUTMAN, for over ten years connected with the Buckeye Engine Company, and for several years manager of its Chicago office, has accepted the position of sales manager of the Corliss and high-speed engine department of the Atlas Engine Works, Indianapolis, Ind. Mr. Troutman's headquarters will be at the home office.

MR. NORMAN McD. CRAWFORD, for a number of years manager of the Hartford (Ct.) Street Railway Company, until its absorption by the Consolidated Railway Company in 1905, has accepted the position of vice-president of a system of interurban lines in Indiana and Ohio, of which the Cincinnati Northern Traction Company is the holding company. The system operates some 1,000 miles of road. His headquarters will be at Cincinnati, Ohio. Mr. Crawford recently returned from England, where he had spent six months investigating electric railways for the National Civic Federation.

MR. WILLIAM H. FOX has been appointed manager of the Burlington (Vt.) exchange of the New England Telephone and Telegraph Company. Mr. Fox graduated from Phillips Andover Academy and entered the Massachusetts Institute of Technology with the class of 1897. Two years after the completion of his course at the institute he entered the employ of the New England Telephone and Telegraph Company as an operator in the Lowell (Mass.) exchange. Shortly after he was transferred to Salem as chief operator. Later he returned to Lowell, where he took up inspection and instrument work, and also devoted some time to office work. From Lowell Mr. Fox was transferred to Worcester, Mass., where he was employed in the inspection department, until he was appointed assistant manager of the Milford and Franklin exchanges. Six months later he became manager of the South Framingham exchange district. He remained in this position nearly three years, when he went into the executive offices of the company in Boston, where he has been located for the past two years.

OBITUARY NOTE.

MR. JAMES DREDGE, for forty years connected with *Engineering*, London, died on August 15 at Pinner, England, in his sixty-seventh year. Mr. Dredge was born at Bath, England, in 1840, the son of a well-known civil engineer. He received his professional training under his elder brother, also a civil engineer, and until 1864 was employed in various engineering offices in London. During the latter years he was thrown with Mr. Zerah Colburn in certain literary work, and when the latter, in 1864, established *Engineering*, he persuaded Mr. Dredge to take charge of all matters connected with illustrations. From this time until a few years ago Mr. Dredge had given his attention almost entirely to building up this paper. He was much interested in all the great international exhibitions held during the past twenty years. For his distinguished work in these connections he was appointed an officer of the Legion of Honor and made a companion of the Order of St. Michael and St. George. He made numerous visits to this country and prepared studies on certain engineering undertakings. About three years ago Mr. Dredge suffered from an attack of paralysis, from which he never fully recovered, although for about a year he continued to devote a good deal of time to the editing of *Traction and Transmission*, a journal which he had established. He was a member of the Institution of Mechanical Engineers, of Great Britain; the Institution of Civil Engineers, of Great Britain; an honorary member of the American Society of Mechanical Engineers, and served for some time on the council of the Society of Arts.

NEW INCORPORATIONS.

LANSING, MICH.—St. Clair Edison Company, St. Clair. $100,000.

ST. PAUL, MINN.—St. Clair Telephone Company, St. Clair. $10,000. Incorporators: H. Thielman, H. A. Campbell, F. Zink and others.

MADISON, WIS.—Wausau Street Railway Company, Wausau. $60,000. Incorporators: Neal Brown, V. A. Alderson and M. C. Ewing.

TRENTON, N. J.—Muscatine Light and Traction Company. $600,000. Incorporators: H. O. Coughlan, B. S. Mantz and John R. Turner.

COLUMBUS, OHIO—National Electric Light Company, New Jersey. $650,000. Admitted to Ohio to locate in Cleveland. J. M. Lee, representative.

ST. PAUL, MINN.—Nelson Telephone Company, Nelson. $10,000. Incorporators: John Nelson, C. F. Schelin, N. O. Johnson, H. J. Ernster and J. P. Larson.

AUSTIN, TEX.—Citizens' Railway and Light Company, North Fort Worth and Arlington Heights. To construct suburban railways and sell electricity. $1,000,000. Incorporators: Warren Ecknell, W. O. Allen, George E. White, Sam Rosen and G. E. Montgomery.

HARRISBURG, PA.—Womelsdorf & Myerstown Street Railway Company. To build an electric railway about eight miles in length, completing a line from Harrisburg to Reading, nearly sixty miles. $50,000. Incorporators: William McIlvain, Walter A. Rigg, J. Milton Miller, Harry R. Riegel and W. K. Eckert, all of Reading.

NEW MANUFACTURING COMPANY.

READING, PA.—Arrowsmith & Company, Incorporated, have filed their charter of incorporation. The company will deal in electrical supplies of every description and is capitalized at $10,000. The sum is divided into shares of $50 each, held by A. V. Arrowsmith, S. S. Arrowsmith and P. K. High, all of this city.

ELECTRIC LIGHTING.

COOKEVILLE, TENN.—Prominent business men of Algood are installing a $15,000 electric light plant.

BURLINGTON, IOWA—Sibley is to have a new lighting plant, upon which work is to be begun at once.

COLUMBUS, OHIO—The citizens of Westerville will shortly vote on the proposition of establishing a municipal electric light plant.

HAVELOCK, NEB.—An electric light plant for Havelock is now assured. P. T. McGere, who secured a franchise several months ago, will begin work on the system shortly.

LOGAN, OHIO—Logan will erect a municipal electric light plant next spring. L. B. Engle is president of the board of trustees of public affairs.

CARBON, IND.—J. H. Bennett, of Brazil, has made arrangements with the Carbon town council to begin operating the electric light plant which has been idle for several months.

BOSTON, MASS.—The gas commissioners have authorized the Worcester Electric Light Company to issue 2,000 additional shares of stock at $160 a share, to pay for additions to the plant.

BEARDSTOWN, ILL.—The city council has made a five-year contract with the Beardstown electric light company for seventy street lamps and forty incandescent lamps at a cost of $330 a month.

WILMINGTON, DEL.—The new plant of the Wilmington Light, Power and Telephone Company is rapidly nearing completion, and it is now assured that the company will furnish electric current by October 1.

RICHMOND, IND.—The Richmond council has approved the contracts entered into by the board of public works with the electrical supply companies for the additions to be made at the municipal electric light plant.

BOSTON, MASS.—The gas commissioners have refused the petition of the Hyde Park Electric Light Company to issue $62,500 additional capital stock for the payment of liabilities on account of additions to the plant.

LOGANSPORT, IND.—With a view to taking over the Andrews Light and Water Company's plant, which is now in the hands of a receiver, residents of Andrews are endeavoring to organize a company among themselves.

DAYTON, OHIO—The Dayton Citizens' Electric Light Company has negotiated the purchase of property at Third and Webster streets for a site for its new power plant. The price paid was $60,000. The company will erect a $200,000 power plant.

WILKESBARRE, PA.—The Dickson Electric Light Company, which has operated a plant for years in the borough of Dickson, besides supplying Throop borough with light, has been sold to the Scranton Electric Light Company for $30,000.

PARIS, ILL.—The city water board at a recent meeting took up the question of a new electric light system for the city. It was decided to send City Engineer Blackburn to St. Joseph, Mo., where the magnetite system is in use, with a view of installing the system here.

LINTON, IND.—The Linton city council has voted to accept the proposition of Samuel Parrott, of Indianapolis, to lease the city electric light plant for five years. Mr. Parrott took charge of the plant September 1 and will operate it at his own expense for the five years.

FLINT, MICH.—The Fenton Light and Power Company, the recently reorganized company which took over the Fenton gas and electric plant, has filed notice of a trust mortgage for $50,000 to the Detroit Trust Company to cover an issuance of bonds to make improvements in the plant.

SPOKANE, WASH.—The Chiwaukum Power and Tunnel Company, headed by O. Gondler, has filed notice at Chiwaukum, west of Spokane, of water rights in the Chiwaukum river. The stream has a drop of more than 2,000 feet per mile for more than nine miles, and it is estimated that 100,000 horse-power is available.

GARY, IND.—Articles of incorporation have been filed at Indianapolis for the incorporation of the Gary Light, Heat and Water Company. The capital stock is $10,000. The directors of the new concern are: George A. Thorpe, Thomas J. Hyman, A. F. Knotts, Kemper K. Napp and Eugene Buffington. The company will establish an electric plant at Gary.

MOUNT VERNON, OHIO—M. W. Hisey, of Zanesville, has purchased the Mount Vernon Electric Light Company, the Mount Vernon Electric Street Railway and Lake Hiawatha Park. The consideration amounted to $100,000, and a similar sum is to be spent by Mr. Hisey in improvements. The properties were purchased from the Jackson-O'Neill syndicate.

COLVILLE, WASH.—The Northern Electric Company, with its principal offices in Spokane, has filed a deed of trust in the office of the county auditor by which it transfers to the Spokane & Eastern Trust Company, of Spokane, all of its electrical plant and property at Newport for a consideration of $15,000. The deed is made to secure an issue of $15,000, ten-year six per cent bonds, of denominations of $500.

STILLWATER, MINN.—The Stillwater Gas and Electric Company will increase its facilities by building an electric power-house near its gas house. R. S. Feurtado, superintendent, says that all plans for the improvement have been made. The Apple river plant of the company is overtaxed to supply power for St. Paul and other points, and the new facilities will be used to tide over all emergencies which may arise.

SPOKANE, WASH.—The Hancock Irrigation and Power Company, recently incorporated for $250,000, with J. A. Young, formerly of Spokane, as president, is planning to erect a large power plant at Priest Rapids, where 50,000 horse-power will be developed. It is expected to irrigate 25,000 acres of land in the northeastern part of Benton county, southwest of Spokane, the water coming from the Columbia river.

HAVERHILL, MASS.—The board of gas and electric light commissioners has approved the petition of the Haverhill Electric Company that it be permitted to issue additional capital stock to the amount of $75,000. This increase is to be devoted solely to two purposes: $62,500 for the payment of outstanding promissory notes, and $12,500 to defray the expenses of making additions to the company's plant. The board also fixes the price at which the new shares shall be offered for sale at $160.

SPOKANE, WASH.—W. A. White, of New York, who is heavily interested in the Washington Water Power Company, of Spokane, announces that the company's Medical Lake line will soon be extended into the Big Bend country, and that it will also supply power for lighting and other purposes to the various towns along the railway. The plant at Post Falls, Ida., is now in operation, and Mr. White says there is sufficient power to extend the line to Colfax and Palouse, 100 miles, and tap a dozen other towns south of Spokane.

ALBANY, N. Y.—The Southern Dutchess Gas and Electric Company, of Fishkill and Matteawan, an electric light company operating under lease the plant of the Citizens' Railroad, Light and Power Company, has made application to the commission of gas and electricity for consent to issue bonds to the amount of $90,000 for the purpose of acquiring and improving the property lately owned and operated by the Fishkill and Matteawan Gas Company, a gas plant recently sold under forclosure of a mortgage given to the Knickerbocker Trust Company to a committee of the bondholders.

TEXARKANA, TEX.—At a meeting of the city council on the Texas side of town an ordinance was adopted, giving to W. P. Harrison and associates, owners of the Texarkana Telephone Company, a franchise to establish and operate an electric lighting plant and system in that section. J. B. King, the local representative of the company, states that he expects to have the plant installed and in operation not later than January 1 next. By the provisions of the franchise electric lights are to be furnished the public at a rate approximately one-third less than is now being paid.

BAKER CITY, ORE.—General Manager John Thomsen, of the Freemont Power Company and the Red Boy mine, situated in the Granite district, about thirty miles west of Baker City, reports that he will have the Olive Lake power plant in operation by Octo-

ber. This plant will furnish 5,000 horse-power and will not only operate the Red Boy mine, which is to be rehabilitated, but will furnish power for neighboring mines and cities. This is one of the largest undertakings in recent years in the Baker City mining camps. Machinery has been delivered and most of it is in place.

GRAND RAPIDS, MICH.—The Boyne River Power Company has filed articles of association with the secretary of state. The capitalization is placed at $100,000, all of which is subscribed. The company will acquire the flowage rights on the Boyne river owned by E. A. Stowe and C. C. Follmer and will erect a thirty-two-foot dam three miles east of Boyne City, utilizing power to light this city. The company will furnish power to Boyne Falls, Clarion and the resorts on Walloon Lake. Frederick C. Miller will manage the concern, with headquarters at Boyne City. Work on the construction of the dam will be started at once.

COLORADO SPRINGS, COL.—A proposition has been submitted to the city council by William Gessford & Company. Mr. Gessford offers to furnish Colorado City with all the electric current necessary to light the city free of charge for twenty years, providing the city will erect and maintain at its own expense the necessary poles, wiring and street lamps, also that a proper and just agreement be made as to the price of electricity for use in business houses and residences. Mr. Gessford proposes to furnish the current from a plant which is to be located near Manitou on French creek. A similar proposition has been made by Mr. Gessford to the Manitou city council.

WATERTOWN, N. Y.—J. O. Mange, general manager of the Watertown Electric Light Company, is superintending extensive improvements that are being made by his concern. In the building on Main street a plant almost new will be installed. C. B. Hodge & Company are the contractors for the work and have started to remove practically everything from the building, leaving only the four walls and the roof. Concrete floors will be placed throughout the structure. A new wheel pit, generator pit and concrete flume are in course of construction. A new switchboard is being installed, and all the old apparatus that will be used again is being thoroughly renovated. The new generators, the water power that the company is now buying and other new facilities will double the capacity of the plant.

ORANGE, N. J.—By a unanimous vote the common council of Orange decided to proceed with the erection of a municipal electric plant for street lights. The plant is to be built in conjunction with the water-pumping plant, under a law which was passed by the legislature last winter. Complete plans and specifications for the plant will be submitted in September, and the bids for the work will be advertised for, to be received about September 20. It is expected that contracts will be awarded by October 10, and the plant will be completed, if the figures are satisfactory, by February. This will make Orange the first city in New Jersey to erect a municipal lighting plant. After the plant is in operation the question of going into the private lighting business will be submitted to the voters. At present Orange pays $85 an arc light of 2,000 candle-power. According to Consulting Engineer Seymour the cost under municipal operation will be less than $50 a year. Mr. Seymour is to run the plant for the city for six months after it is installed. The plant will be used also for pumping for the water and sewer departments.

DENVER, COL.—The board of supervisors at a special meeting ratified the terms of the charter amendment carried at the election, May 15, providing for a reduction in the price of street arc lights from $90 to $60 per year. The new rate dates back to June 1 and saves the city $3,000 a month in the light bill. In return for this reduction in rates the city abrogates its right to purchase the Lacombe lighting plant. By the terms of the franchise granted the Lacombe company in 1901 the plant was to be sold to the city at its option, the opening price being $225,000. A credit of $20,000 per year was to be given the city on the purchase price. To date this amounts to $100,000, leaving the plant open to purchase for $125,000. An eastern expert last spring, after an examination of the property, stated it would require an investment of $400,000 to put the Lacombe plant in proper condition to supply the demand, and that an entirely new plant would be a better investment. Mayor Speer then urged the adoption of a charter amendment to abrogate the purchasing clause and for the company to give a $60 rate for ten years. The provision also calls for 2,000-candle-power arc lamps, the same as furnished under the $90 per annum contract.

UTICA, N. Y.—The engineers and foremen of the tower line of the Hudson River Electric Power Company have commenced work on the line between Utica and Clark Mills. The line will be tapped at Clark Mills to furnish motive power for the electrification of the West Shore Railroad between Utica and Syracuse. Power is now being delivered in Amsterdam over the tower line, and construction is under way west of Amsterdam toward Utica. It is expected that the tower line will be completed into Utica in the fall. The steam turbine plant will then be used only as an auxiliary, the main power being furnished directly from Spier falls. The company will be able to deliver all the power needed in Utica for the operation of the trolley system, manufactories and lighting. About thirty men have been placed at work between Utica and Clark Mills. The tower line runs from Utica at the power plant to Yorkville, New York Mills, then to Clark Mills. The distance of the line to Clark Mills from Utica is about seven miles and from Clark Mills to Amsterdam, sixty-two miles. The towers are fifty-five feet high, of steel, seventeen feet square at the base, and rest on concrete foundations. They will carry a double circuit of three wires each, with an extra wire for emergency. The work between Utica and Clark Mills will be completed in about six weeks. The construction costs about $5,000 per mile.

ST. LOUIS, MO.—Harbor and Wharf Commissioner Whyte at a meeting of the St. Louis board of public improvements, suggested an ordinance for the letting of a twenty-year contract to light the streets, parks and public places in St. Louis. If the bids received do not reach the proper figure, Mr. Whyte suggests that a municipal lighting plant be installed. The present lighting contracts will expire on August 31, 1910. When the last contracts were let, in 1900, the city was kept in darkness for several weeks by the failure of the municipal assembly to make any provision for lighting during the letting period. Mr. Whyte claims that the prices, which now average $98 a year for arc lights, should not be more than $60 or $65 a year. These prices are based on the operating expenses of the municipal lighting plant at Detroit, Mich. The city could save, Mr. Whyte says, by these lower prices, enough money to brilliantly light the business district of the city. His figures are based on the use of 2,000 lamps, which will result in a saving of $150,000 a year. Thomas Carter, supervisor of city lighting, has been working on plans for a municipal lighting plant for some time. It is estimated that the cost of erecting a municipal lighting plant with its necessary conduits in the so-called underground district would be $800,000. The operating expenses for such a plant is estimated at $400,000 a year. Even at the maximum price of $70 for each lamp 700 new lamps could be installed each year.

PASADENA, CAL.—By an act of the city council a plan has been evolved whereby funds amounting to $52,000 are to be provided through direct taxation for the immediate construction of the municipal light plant, for which the citizens voted bonds some time ago. When the council met two ordinances were read. One creates the department of municipal electric lighting works and provides for a general manager. The other fixes the tax levy at $1 on each $100 of valuation for all municipal purposes and fifteen cents for school purposes. A levy of eighty-two cents per $100 valuation on the city assessment will provide sufficient funds to maintain all the city departments. The eighteen cents extra levy will provide a fund of $52,700, as the total taxable wealth for general purposes is $29,310,065, and the fund thus derived will be used to establish a municipal lighting plant. Charles C. Glass, an electrical engineer, who was engaged by the city some weeks ago, has prepared estimates for the installation of a suitable power-house and the establishment of 100 arc lights and 1,500 incandescent lights of sixteen candle-power each. He places the cost of maintenance at $7,000 per year. The total cost of the plant as planned will be $51,700, leaving $1,000 derived from the extra levy to go toward the operating expenses. With the money left in the lighting fund this year and the $14,000 that has been placed in the budget for lighting purposes the city will have $21,000 in addition to the $1,000 to be devoted to maintenance and extensions. The council figures that the light bills of the Edison company average $1,425 per month, or $17,000 per year. The city plant will cost only $7,000 to maintain, leaving $10,000 for a sinking fund.

ELECTRIC RAILWAYS.

OWOSSO, MICH.—J. A. Phick has been granted a franchise for an electric line through the streets of Owosso.

COLUMBUS, OHIO—An addition to the power-house of the Columbus Railway and Light Company is to be built.

NEWARK, N. Y.—The Rochester, Syracuse & Eastern Railroad Company is operating its line from Lyons to Fairport, a distance of twenty-five miles.

WESTFIELD, MASS.—A deal has been consummated by which the Woronoco and Western Massachusetts Street Railway companies pass into the hands of the Springfield Street Railway Company.

EASTON, PA.—President Fehr, of the Easton Transit Company, has closed contracts for thirteen new cars and other equipment for the company's lines now in operation and those under construction.

CLEVELAND, OHIO—The new Cleveland Electric Railway franchise ordinance will provide for a franchise grant of twenty years, practically universal transfers and seven tickets for a quarter with five-cent cash fare.

CHICAGO, ILL.—The Chicago & Milwaukee Electric line between Kenosha and Racine was opened for traffic on September 1. Through trains run between Evanston, Ill., and Racine, Wis., in one hour and forty minutes.

STEUBENVILLE, OHIO—An ordinance for a double-track interurban railroad along the Ohio river has been passed by the council, giving the Ely syndicate and the Steubenville Traction Company a franchise for twenty-five years.

PARIS, ILL.—Word has been received that the contract for the construction of the Paris-Charleston interurban line has been awarded to the Wallace-Coates Engineering Company, of Chicago, and that work will be commenced at once.

MORRISTOWN, N. J.—Residents of Morristown voted to grant a franchise to the Morris County Traction Company to operate an electric street railway on Speedwell avenue, from the park to the town limits. It is Morristown's first trolley line.

BISMARCK, N. D.—The Hughes Electric Company has leased the state's electric street-car line for two years and will run it upon a continuous service, thus shortening the present running time over one-half. The rental is understood to be but nominal, the line having been a heavy loser.

PITTSBURG, PA.—A new street railway company is being organized in Homestead, to be known as the Homestead, Whitaker & Homeville Street Railway. It is proposed to connect the three towns named and Munhall, and to build about five miles of line. The company will have $25,000 capital.

CINCINNATI, OHIO—At the annual meeting of the Mansfield Railway, Light and Power Company an excellent statement of earnings for the year was made, and the following officers were elected: Leopold Kleybolte, president; Arthur S. Huey, vice-president, and George Koehler, secretary and treasurer.

BURLINGTON, IOWA—The Burlington board of supervisors has granted to B. L. Behr and associates, of St. Louis, permission to use the upper Augusta country road for a period of twenty-five years for an electric railway line, on condition that the same be built and in operation by September 1, 1909.

SHARON, PA.—The Mahoning & Shenango Street Railway Company will spend $1,000,000 for new equipment in Sharon, Youngstown and New Castle. Included will be about fifty modern street cars. The recent statement made by the company shows that it is earning satisfactory interest on its investment.

MEMPHIS, TENN.—Surveyors have begun a preliminary survey for an electric railway from Covington, Tenn., to Memphis, about thirty miles, and almost parallel to the Illinois Central. Business men at Covington and along the route have subscribed to pay the survey, and they propose to build the road.

JACKSON, TENN.—The Jackson Railway and Light Company has let the contract for the construction of a new power-house. All preliminary arrangements for the extension of the car lines to Bemis have been completed, and the company expects to have cars traversing the new route within the next nine months.

CARROLLTON, GA.—Interest is again being aroused in the proposition of erecting an electric railway line from Villa Rica to Carrollton, Bowden, Franklin, Heard county, and thence to some convenient point in Alabama. Ample capital has been secured if sufficient cooperation by the people at these points and the granting of the right of way can be had.

GUTHRIE, OKLA.—The city council of Edmond has granted a franchise to the Newkirk, Tonkawa & Southern Interurban Company which proposes to build an electric line connecting the principal towns of Kay, Noble, Logan and Oklahoma counties. The company puts up a $500 cash guarantee to begin work within the city limits inside of ninety days.

CHANUTE, KAN.—It is reported that contracts have been let for the Rawlins interurban electric system. This system will be 150 miles long and will extend from Chanute to Joplin, Mo. There will be two branches, one running from Chanute *via* Thayer to Cherryvale, Coffeyville and Independence, and the other *via* Erie and Parsons to Columbus, Weir, Galena and Joplin.

CHENEY, WASH.—Charles P. Lun, of Spokane, is at the head of a company which will build an electric railway between Spokane and Cheney, Wash., eighteen miles, to be in operation early next year. Franchises have been granted by the towns of Hayford and Cheney. The line will be equipped with two high-power sixty-foot coaches, and it is planned to make seven trips daily.

SPOKANE, WASH.—W. H. Plummer, president of the Spokane & Big Bend Electric Railway Company, is authority for the statement that the line between Spokane and Davenport, Wash., will be in operation before June, 1907. Surveys have been completed and seventy-five per cent of the 120 miles of right of way has been secured, and it is stated that work will begin some time this month.

NEWBURGH, N. Y.—The Orange County Traction Company has been purchased by a local syndicate of which ex-Governor Odell is the head. The company owns about twenty miles of line. For three weeks there had been a strike of the regular employés, and strike-breakers have been running the cars. The new owners have made a settlement with the men and are said to have granted every demand.

NAPA, CAL.—Preliminary steps are under way for the construction of the new electric road to be built by the Bay Counties Railway Company from Napa to San Francisco, a distance of forty-five miles. The route of the railroad will be from San Francisco to the Marin county shore by ferry and from there to Napa by electric road. At the Napa line it will connect with the Napa and Lake Port Railroad.

STERLING, ILL.—An electric road from Belvidere to Geneva lake is a part of the building project of the company which is back of the purchase of the De Kalb-Sycamore line, and which proposes to build from Sycamore to Genoa and from Genoa to Belvidere. The incorporation papers also provide for lines to a number of other cities, but the Belvidere line is the one to which the company will first devote its attention.

NEW WESTMINSTER, BRITISH COLUMBIA—After returning from his trip over the proposed Chilliwack line, Managing Director Buntzen, of the British Columbia Electric Railway Company, stated that the cost of construction was estimated at $1,250,000, and that the company would endeavor to have the line built within two years of the completion of the surveys. The running time from New Westminster would be about three hours.

NEW HAVEN, CT.—In addition to the double-tracking of the Consolidated Railway from Lake Whitney to Mount Carmel, which is to be undertaken, the Connecticut Railway and Lighting Company contemplates double-tracking its line from Mount Carmel to Cheshire, and possibly to Waterbury, so that by another year the summer travel between these points, and as far north as Meriden, will be greatly facilitated. This will do away with the present delays in making connections.

BRISTOL, TENN.—The Bristol Belt Line Company is making preparations to extend its electric car line over the various streets

of Bristol, Va. Up to this time its tracks have all been in Bristol, Va., except for a short time a few years ago, when its cars reached the Virginia Institute, on the northern suburbs. The line was taken up and removed because of a disagreement with the city council regarding the duty of the Belt Line Company in regard to keeping up the streets on which its line ran.

PHILADELPHIA, PA.—The tracks of the Morton, Swarthmore & Media trolley line have been connected with those of the Philadelphia Rapid Transit Company on Woodland avenue above Ninth street in Darby. This will give the Philadelphia Rapid Transit Company a through line to Media and Chester, independent of the lines of the Chester Trolley Company. The former company recently secured a lease of the Morton, Swathmore & Media line. Its cars have hitherto run only to the Darby terminus.

SPOKANE, WASH.—E. P. Coles, of Philadelphia, who is one of the backers of the Lewiston & Southeastern Railway, and E. M. Scofield have returned to Spokane from a trip over the proposed electric line between Lewiston, Ida., and Grangeville, and announce that the railway will be built. It is likely that the Idaho Development Company's plant on the Salmon river will be acquired when the company will furnish power to the Buffalo Hump mining district in western Idaho. The railway will tap rich agricultural districts on the Nez Perce and Camas prairies.

ROCHESTER, MINN.—Southern Minnesota capitalists are considering the leasing of the Winona-Rochester branch of the Chicago Great Western and turning it into a trolley line. This piece of track, it is said, is being used less frequently every year, and it is believed that little difficulty would be found in inducing the railroad officials to lease it. The cost of converting the railroad into a trolley line would not be great. The plans of the promoters have not yet been entirely perfected, but, it is said, they are about ready to open negotiations with the railroad officials.

WASHINGTON, D. C.—The stockholders of the East Washington Heights Traction Company at their annual meeting elected the following directors: O. C. Brothers, Jr., C. A. Barker, Arthur E. Randle, D. C. Fountain, George H. Judd, S. R. Norman, A. L. Martin, C. B. Hilliard and James E. Davis, of Baltimore. The United States Realty Company, of Washington, holds a controlling interest in the road, which was established to provide rapid transportation to Randle Highlands, and the other properties which are being developed by this company. The road extends from the eastern terminus of the Capital Traction Company over the Pennsylvania avenue bridge to Minnesota avenue.

EAU CLAIRE, WIS.—The plans of the Chippewa Valley Electric Railroad Company with regard to carrying out the projects in connection with the granting of the franchise, which extends until 1928, have been outlined by C. T. Bundy. Surveyors will be put to work next week to lay out the interurban line between Eau Claire and Menomonie. A prominent engineer of Minneapolis has been engaged to superintend the work of developing power from the Red Cedar and installing new wheels at the Dells dam, and the reconstruction of the Eau Claire light and power plant. It is also proposed that outstanding bonds of the Chippewa Valley Electric be retired and new ones issued in order to realize part of the money needed to carry out the projects under consideration.

LA CROSSE, WIS.—A project which contemplates the construction of an electric railroad system from Menomonie to Chippewa Falls, Eau Claire, Black River Falls and La Crosse has been proposed. The plan as conceived is to extend and recapitalize the Chippewa Valley electric railroad, which now runs from Chippewa Falls to Eau Claire. Arrangements have been made for the issuing of new bonds and realizing part of the money needed for the development of new power. There is a possibility, if the plan is carried out and the line is extended to La Crosse, that the La Crosse Water Power Company may supply the power from its dam now building at Hatfield, for part or all of the system of railroad.

PITTSTON, PA.—The Lehigh Valley Railroad Company, backed by capitalists from New York and Wilkesbarre, is about to enter negotiations for the electrification of a branch of the road from Tunkhannock to Montrose and for the construction of an extension of the line from Montrose to Binghamton. From authentic sources it has been learned that the surveys are complete, and the financial backing for the project has been secured. Although no definite date has been fixed, it is understood that plans are being made for the commencement of construction early next spring, and it is believed that the installation of the electric system on the Montrose branch of the Lehigh, at least as far as Lake Carey, will be taken up at about the same time.

LIMERICK, ME.—Plans for a new electric railroad to be known as the Ossipee Valley Line, to run between Springvale and Bridgton Junction, are being perfected and a charter will be petitioned for at the next session of the legislature. The road is to be forty miles long, running through the towns of Hiram, Sanford, Shapleigh, Newfield, Limerick, Parsonsfield, Porter and Cornish. The capital stock will be $160,000. A meeting of those interested was held recently, and the following directors were elected, at least one representative being chosen from each town through which the road will pass: George W. Hanson, of Sanford; Prescott A. Thing, of Shapleigh; Harry H. Moore, of Newfield; Charles G. Moulton, of Limerick; J. Merrill Lord, of Parsonsfield; Allen Garner, of Parsonsfield; Owen L. Stanley, of Porter; H. Kimball, of Cornish, and Milton Easton, of Limerick.

LOUISVILLE, KY.—The first steps toward paralleling the Chicago, Indianapolis & Louisville Railway, the Monon route, from Chicago to Louisville, entering Louisville from Jeffersonville, have been taken at Indianapolis, where articles of incorporation of the Chicago & Western Indiana Traction Company have been filed. The directors are Edward H. Barrows, Daniel W. Bolen and John S. McCulloch. The capital stock is fixed at $100,000. It is set forth that the line will pass through Lake, Porter, Newton, Jasper, Benton, White, Tippecanoe, Montgomery, Putnam, Owen, Monroe, Lawrence, Orange, Washington, Floyd and Clark counties, which is the identical route of the Monon from Chicago to Louisville. The line is to be called the "Educational Route," from the fact that, if built, it will pass through Lafayette, Crawfordsville, Greencastle and Bloomington, at which places large colleges are located, the Indiana State University being at the last named.

ST. LOUIS, MO.—The St. Louis county court has granted the franchise sought by the Hillsboro, Kimmswick & Northern Railway Company for an electric road from the southern part of the city to the line between Jefferson and St. Louis counties. The franchise carries with it the right to build a bridge over the Meramec river for the railroad, wagons and pedestrians. The line is to extend from the terminus of the Jefferson Barracks road southwesterly to the bridge, which is to be located near Telegraph and Fine roads. The company is to improve the bridge approach at its own expense. The final terminus of the line is to be at Montesano park, and is to be completed within two years. Private right of way is to be used for the entire distance. A five-cent fare is all that can be charged for the run through St. Louis county. Cars are to be operated each way at least thirty minutes apart from early morning to midnight and at least one hour apart between midnight and morning. The company will be required to file a bond for $5,000 to indemnify the county and deposit $1,000, upon which the court may draw to make repairs.

SPOKANE, WASH.—Jay P. Graves, president of the Inland Empire Electric Railway Company, whose bonds to the extent of $30,000,000 were recently underwritten by E. H. Rollins & Sons, of Boston, and Peabody, Houghtaling & Company, of Chicago, announces that the line of the Spokane & Inland Railway will be extended from either Moscow, Ida., or Palouse, Wash., to the Snake river with a view to making Lewiston, Ida., giving the road 150 miles of line. The new line between Spokane and Lewiston will be thirty-five miles shorter than the Northern Pacific line between the two points. Work is to begin the coming fall. F. A. Blackwell, chairman of the finance committee, also announces that a line from Spokane to Lake Pend d'Oreille, Ida., fifty-six miles, will be in operation in a year. This line is in opposition to the projected railway by the Spokane-Lake Pend d'Oreille Rapid Transit Company, of which C. H. Reeves, one of the original owners of the famous Hercules mine, is president. The last-named company has run its surveys, secured right of way and terminal grounds in Spokane and at Squaw Bay, Ida. The outcome of the fight for supremacy is being watched with interest by railway men in the Pacific Northwest, as both concerns claim title to the lake property.

INDUSTRIAL ITEMS.

THE MARSHALL ELECTRIC MANUFACTURING COMPANY, Boston, Mass., announces that the new push-button switch with fibre false plate is meeting with a large demand. The company is increasing its capacity in this line to keep pace with orders.

THE AITON MACHINE COMPANY, New York city, has ready for shipment a four-head tandem armoring machine. This is one of the largest machines for armoring ever built, and it should prove of interest to manufacturers making armored cable. The machine can be seen at the Harrison, N. J., works of the company.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., enjoys the distinction among supply houses of having a room fitted up and devoted exclusively to the display of fixtures. This is located on the first floor of the new building at 264-270 Fifth avenue, in connection with the company's retail department, and all the latest styles and finishes of electric and combination fixtures are found on exhibition.

THE SUNBEAM INCANDESCENT LAMP COMPANY, Chicago, Ill., has issued an attractive booklet of verses entitled "Scintillating Sunbeams." This is a pleasing little originality illustrated with appropriate line drawings. A copy will be sent to any one interested, upon request, to the general distributing agent for the Sunbeam lamp, the Western Electric Company, Chicago, Ill., or any of its branch houses.

THE WESCO SUPPLY COMPANY, St. Louis, Mo., is placing on the market its Wesco soldering paste and Wesco soldering stick, particularly adapted to armature work, especially in connection with soldering the armature leads to the armature. The company announces that the Wesco stick or paste has a tendency to act more as an insulator than as a conductor of current, so that if any of it is left in the armature there is no danger of its causing a burnout.

FAIRBANKS, MORSE & COMPANY have placed the management of its eastern electrical department in the hands of Baxter Reynolds, with offices at the company's headquarters, 12 Dey street, New York. Mr. Reynolds is a graduate of the technical and engineering courses of the Sheffield Scientific School at Yale University, and prior to his present connection Mr. Baxter was identified with the Nernst Lamp Company. Fairbanks, Morse & Company have taken over a line of alternators and dynamos and motors which have heretofore been manufactured by the Commercial Electric Company, of Indianapolis.

THE NATIONAL BRAKE AND ELECTRIC COMPANY, Milwaukee, Wis., reports the following recent orders for electrical machinery: George W. Pitkin & Company, Chicago, Ill., one 100-kilowatt engine-type alternator; Clinton Sugar Refining Company, Clinton, Iowa, one 400-kilowatt and one seventy-five-kilowatt engine-type alternator; Alliance Electric Light and Power Company, Alliance, Neb., one 100-kilowatt belted-type alternator; Fort Morgan Electric Light and Power Company, Fort Morgan, Col., one seventy-five-kilowatt engine-type alternator; Stillwater Gas and Electric Company, Stillwater, Minn., one 250-kilowatt engine-type alternator; Clymer Power Company, Riegelsville, Pa., one 500-kilowatt water-wheel alternator; Hendrie & Bolthoff Manufacturing and supply Company, Denver, Col., two 150-kilowatt water-wheel alternators; Rockford Malleable Iron Works, Rockford, Ill., one 200-kilowatt engine-type direct-current generator; Romadka Brothers, Milwaukee, Wis., one 150-kilowatt engine-type direct-current generator.

THE BALL ENGINE COMPANY, Erie, Pa., announces the following recent sales of its new design side crank automatic engine: one 100-horse-power, Commonwealth Trust Company building, Pittsburg, Pa.; two 200-horse-power, Commonwealth Trust Company building, Pittsburg, Pa.; one 200-horse-power, Chicago Varnish Company, Chicago, Ill.; one 165-horse-power Holdrege Lighting Company, Holdrege, Neb.; one 100-horse-power, Holdrege Lighting Company, Holdrege, Neb.; one 335-horse-power, Philadelphia Post Office building, Philadelphia, Pa.; one 100-horse-power, Deepwater Railway Company, Deepwater, W. Va.; one 320-horse-power, Henderson Light and Power Company, Henderson, N. C.; one 210-horse-power, T. A. Gillespie & Company, Pittsburg, Pa.; two 320-horse-power, United Hebrew Charities, Chicago, Ill.; one 150-horse-power, Germain-Boyd Lumber Company, Atlanta, Ga.; one 150-horse-power, Washington Gas and Electric Company, Washington Court House, Ohio; one 320-horse-power, Taylor Coal Company, Beaver Dam, Ky.; one 210-horse-power, Isthmian Canal Commission, Washington, D. C.; one 150-horse-power, Natalbany Lumber Company, Montpelier, La.; two 100-horse-power, Jewish Hospital, Cincinnati, Ohio; two 150-horse-power, West Unity Light and Power Company, West Unity, Ohio; two 100-horse-power, Sweetbrier Institute, Amherst, Va.

Record of Electrical Patents.

Week of September 4.

829,951. ILLUMINATED SIGN. John L. Dawes, Pittsburg, Pa. Filed September 29, 1905. A central longitudinal section is perforated and supports the lamps, movable sign-boards being placed on each side.

829,968. RAILWAY SIGNAL AND SAFETY APPLIANCE. Charles J. Kintner, New York, N. Y. Filed June 6, 1904. Renewed December 28, 1905. The supply conductor is divided into sections, and the signals are displayed automaticallly in the presence of a car on any section.

829,969. SAFETY APPLIANCE FOR RAILWAYS. Charles J. Kintner, New York, N. Y. Filed January 27, 1905. Renewed May 9, 1906. A signaling conductor placed adjacent to one of the track rails, the wheel flanges completing the circuit between the two.

829,974. ELECTRICALLY OPERATED MINE-DOOR ACTUATING MECHANISM. John C. Lincoln, Cleveland, Ohio, assignor to the Lincoln Company, Cleveland, Ohio. Filed April 10, 1903. A flexible door carried on a motor-driven roller.

829,975. VARIABLE-SPEED ELECTRIC MOTOR. John C. Lincoln, Cleveland, Ohio, assignor to the Lincoln Company, Cleveland, Ohio. Filed June 27, 1905. The variations in speed are produced by axial movements of a cone-shaped armature in its field.

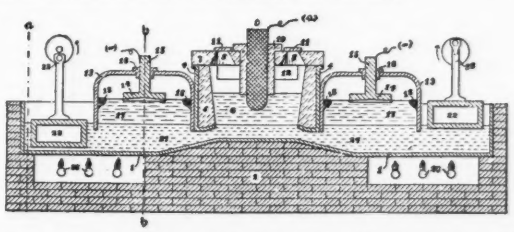
830,025. DYNAMOELECTRIC MACHINE AND THE LIKE. Ludwig Torda, Barking, England. Filed June 2, 1905. Commutating poles are provided, the pole-faces being connected to the main poles by conducting strips.

830,041. ELECTRIC TIME SWITCH. Clayton A. Ballou, Providence, R. I.—Filed June 30, 1905. A clock-driven time switch.

830,051. APPARATUS FOR THE ELECTROLYTIC EXTRACTION OF METALS. Courtland F. Carrier, Jr., Elmira, N. Y., assignor to Elmira Electrochemical Company, Elmira, N. Y. Filed January 30, 1905. The chamber containing the molten material is deeper at the extremities and is divided into compartments by downwardly projecting bells.

830,119. CONTROL OF APPARATUS GOVERNING THE PASSAGE OF CARS OR VEHICLES ALONG A RAILWAY. Herbert A. Wallace, New York, N. Y., assignor to the Union Switch and Signal Company, Swissvale, Pa. Filed June 13, 1906. An electrical method of controlling block systems.

830,131. ELECTRIC RAILWAY SYSTEM. William M. Brown, Johnstown, Pa., assignor to the Lorain Steel Company. Filed April 27, 1905. A closed conduit system in which a sectioned rail is made alive by the passage of the car.



830,051. APPARATUS FOR THE ELECTROLYTIC EXTRACTION OF METALS

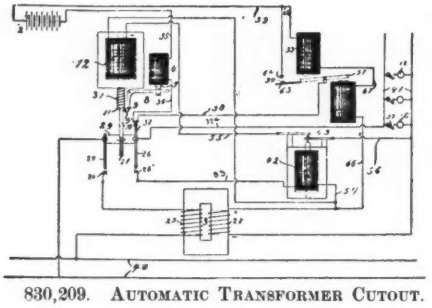
830,158. SYSTEM OF MOTOR CONTROL. Axel Magnuson, New York, N. Y., assignor to Otis Elevator Company, Jersey City, N. J. Filed July 6, 1905. An electric elevator system in which the motor is controlled by means of current from a storage battery which is charged by a generator driven by a motor, the generator also acting as an automatic brake.

830,161. TELEPHONE. John Z. Miller, Erie, Pa. Filed October 30, 1902. A selective telephone system for two instruments on one line.

830,164. ELECTRICALLY OPERATED LINE INDICATOR FOR RAILWAYS. Claud D. McPhee, Arnprior, Canada, assignor of one-half to James Robinson, Montreal, Canada. Filed October 2, 1905. An automatic arrangement for electrically indicating the condition of a track, the signals being sent over the telegraph line.

830,201. PRESS FOR MANUFACTURING ARC LAMP ELECTRODES. André Blondel, Paris, France. Filed November 18, 1902. The press enables compound or hollow carbons to be formed.

830,209. AUTOMATIC TRANSFORMER CUTOUT. De Witt C. Conkling, Hoboken, and John E. Winn, Weehawken, N. J., assignors to Electric Economies Company. Filed November 14, 1904. Renewed February 17, 1906. By means of an auxiliary circuit the primary circuit to the transformer is open when there is no load on the secondary.



830,209. AUTOMATIC TRANSFORMER CUTOUT.

830,217. ELECTRICALLY CONTROLLED OPTICAL APPLIANCE. John C. Fredell, Pocatello, Ida. Filed August 25, 1905. An electrical method of controlling a shutter, such as is used in cameras.

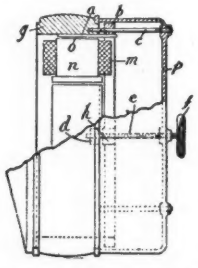
830,242. SYSTEM OF MOTOR CONTROL. Axel Magnuson, New York, N. Y., assignor to Otis Elevator Company, Jersey City, N. J. Filed September 20, 1905. An alternating-current motor drives a small generator, the current from which regulates the rate of acceleration.

830,247. SELECTIVE SIGNAL SYSTEM FOR RAILWAYS. Frank R. McBerty, Evanston, Ill., assignor to Western Electric Company, Chicago, Ill. Filed July 24, 1905. A selective system employing three line wires, enabling a number of independent signals to be made.

830,253. TELEGRAPH KEY. Jesse T. Sheets, Covington, Ky., assignor of one-half to Solomon P. Kineon, Cincinnati, Ohio. Filed November 9, 1905. An improved method of construction.

830,254. FIRE-PROTECTING SIGNAL SYSTEM. John E. Shepherd, Chicago, Ill. Filed April 25, 1904. An electric alarm is sounded whenever the sprinkler system is brought into operation.

830,258. COMBINED REFLECTOR AND CLUSTER FRAME. William H. Spencer, Brooklyn, N. Y., assignor to George Frink Spencer, Newark, N. J. Filed May 2, 1905. A method of constructing a cluster for electric lamps.



830,262. CONTINUOUS-CURRENT ELECTRIC MOTOR AND GENERATOR.

830,262. CONTINUOUS-CURRENT ELECTRIC MOTOR AND GENERATOR. Ludwig Torda, Barking, England. Filed May 6, 1905. Variations in the speed or voltage of the motor or generator are made by means of paramagnetic plates inserted in gaps in the pole-pieces.

830,271. TELEPHONE SYSTEM. David H. Wilson, Chicago, Ill., assignor to Robert Bines, Chicago, Ill. Filed January 2, 1906. The primary windings of the induction coil are on two cores, the secondary being wound on a third placed between them.

830,272. TELEPHONE APPARATUS. David H. Wilson, Chicago, Ill., assignor to Robert Bines, Chicago, Ill. Filed January 2, 1906. Two separate iron cores are provided in the transmitter circuit, the receiver coils being placed on two other cores interposed between the first.

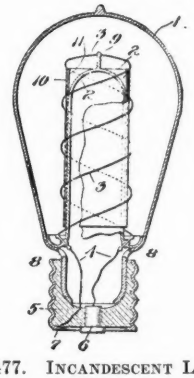
830,279. TELEPHONE TRANSMITTER. Henry F. Albright, New York, N. Y., assignor to Western Electric Company, Chicago, Ill. Filed October 21, 1904. A supporting-plate with a central opening spanned by a bridge-piece which supports one electrode; the cup carrying the carbon granules is mounted on the diaphragm.

830,299. METHOD OF PRODUCING AMMONIA AND CAUSTIC ALKALI. Gunnar E. Cassel, Stockholm, Sweden. Filed August 22, 1904. A solution of a metallic hydroxide is treated by air through which electrical discharges have taken place.

830,306. ELECTRIC LIGHT AND POWER CONTROLLER. Frederich C. Damm, St. Louis, Mo. Filed September 18, 1905. A switch for attaching to and controlled by the person occupying a chair.

830,316. JUNCTION BOX. Edwin T. Greenfield, Monticello, N. Y. Filed October 10, 1904. Lamps are provided for holding the cables in place.

830,317. JUNCTION BOX. Edwin T. Greenfield, Monticello, N. Y. Filed October 28, 1904. Lamps are provided for holding the conduits in place.



830,477. INCANDESCENT LAMP.

830,347. ELECTRIC MOTOR. David Mendelson, New York, N. Y. Filed November 8, 1905. The moving part of the motor is mounted as a pendulum, its motion controlling the flow of current through both movable and fixed coils.

830,364. WATCHMAN'S ELECTRIC TIME CONTROLLER. Pedro Reitz, Munich, Germany. Filed March 6, 1905. Alarms are sounded at predetermined times, except when manually interrupted at various controlling points.

830,391. ELECTROTHERMAL DEVICE. Charles E. White, Chicago, Ill., assignor to Frank B. Cook, Chicago, Ill. Filed June 22, 1903. A protective device for electrical apparatus actuated by air heated electrically.

830,409. TROLLEY. Herschel L. Bryant, Tonkawa, Okla. Filed October 31, 1905. The trolley wheel is automatically thrown outwardly when there is a tendency to leave the wire.

830,419. FIELD-COIL INSULATION AND PROCESS OF FORMING SAME. Louis W. Downes, Providence, R. I. Filed October 22, 1904. A double insulation, the inner being fibrous and the outer of asbestos.

830,457. ELECTRIC BRAKE. Frank L. Sessions, Columbus, Ohio, assignor to Joseph A. Jeffrey, Columbus, Ohio. Filed January 17, 1905. A brake held normally in action, but released by the current operating the motor, acting through a compound-wound magnet.

830,473. ELECTRICAL-WOUND CLOCK. Percy L. Clarke, Bristol, Ct., assignor, by mesne assignments, to the National Self-Winding Clock Company, Champaign, Ill. Filed October 13, 1902. Renewed January 8, 1906. A reciprocating mechanism for clock-winding.

830,474. DRIVING MECHANISM FOR CENTRIFUGALS. William L. D'Olier, Philadelphia, Pa. Filed April 6, 1903. A method of suspending a motor in vertical position.

830,475. POTENTIAL INDICATING DEVICE. George N. Eastman, Chicago, Ill., assignor to Minerallic Company, Chicago, Ill. Filed May 5, 1904. A type of portable electroscope.

830,477. INCANDESCENT LAMP. James W. Forster, Chicago, Ill. Filed March 24, 1905. The filament is wound upon heat-absorbing material, radiation from the inner surface of the latter being prevented.